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Senior Editor CHRIS CHIANELLI
Associate Editor ROGER POST JR.
Editorial Coordinator DANA DONIA

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Publisher YVONNE M. DeFRANCESCO
Associate Publisher SHARON WARNER

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CONTRIBUTORS
Bob Aberle, Dave Baron, Rick Bell, Joe Beshar, Bernard Cawley, Roy L. Clough Jr., Roy Day, Don Edberg, Dave Garwood, Dave Gierke, Henry Haffke, Greg Hahn, Tom Hunt, Michael Lachowski, Andy Lennon, George Leu, Mike McConville, Jerry Nelson, Jim Newman, Jim Onorato, Dave Patrick, Dave Platt, Randy Randolph, Carl Risteen, Jim Sandquist, Keith Shaw, Jim Simpson, Faye Stilley, John Tanzer, Craig Trachten, Rich Uravitch, George Wilson, Dan Wolanski, Nick Ziroli.

AirAGE

100 East Ridge, Ridgefield, CT 06877-4606 USA
(203) 431-9000 • fax (203) 431-3000
Email *man@airage.com*
Internet *www.modelairplanenews.com*

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AUGUST 1999 • VOLUME 127, NUMBER 8

ON THE COVER: main image—Bud Roan's own-design Sopwith Triplane was only one of the magnificent scale models at this year's Top Gun (photo by Debra Sharp). Insets—top right: other Top Gun entries included Bob Violett and Jerry Caudle's TV-1; bottom left: a P-51D built by Bill Stevick and flown by Dean DiGiorgio; bottom center: Bob Underwood's own-design IL2M3 Stormovik (photos by Debra Sharp); bottom right: Ray LeBonte and Peter Flanagan's Harvard Mk IV (photo by Gerry Yarrish).

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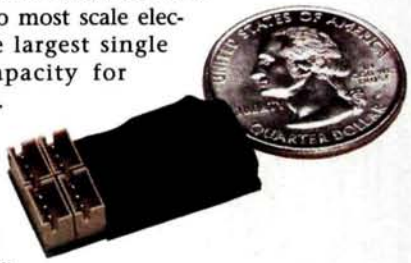
Departments

Looking ahead

While assembling an electric ARF glider the other day, I looked with quiet awe at the composite materials that had been incorporated into the design, and at the refinement and precision with which the wings had been preassembled and covered. Back in the early '80s, I struggled with sheets of balsa and wooden dowels to construct a fuselage and control system for a similar model. I recall the hours that were required to assemble and cover a high-aspect-ratio glider wing made from balsa and spruce. My then fairly inexperienced eyes were filled with wonder at how MonoKote transformed a framed-up, open-bay wing into something that looked very high-tech. Today, with ARF quality standards often exceeding what many of us can achieve at the building board, I remain spellbound both by the advancing technology and the ever-increasing standards of quality in R/C aeromodeling.

Technology advances noted in this and coming issues are mere snapshots of a continuing trend. The RD6000 programmable radio from Airtronics, reviewed by Roger Post on page 54, is strikingly easy to use. The top of the menu starts with "channels," i.e., with parts of the airplane such as the ailerons, rudder, elevator, throttle, etc., and from any of these starting points, you scroll to functions such as servo reversing, endpoint adjustment, etc. Simply put, this menu is easy to use and remember, and such radios make modeling easier even while improving model performance.

Also in this issue, on page 40, Steve Pond reviews the new Panasonic 3000mAh sub-C nickel-metal-hydride cells now exclusively distributed by Trinity. These cells weigh only 1/10 gram more than the previous highest capacity sub-C cells—Sanyo's 2000mAh Ni-Cds. This means that electric aircraft that normally draw 20 to 30 amps at full throttle will have half again the motor run time to perform maneuvers or climb to thermalling altitude. This would include the majority of electrics being flown today, from small- to intermediate-size "floater" electric gliders to most scale electric aircraft. This is the largest single increase in battery capacity for electrics that we can recall.



In Chris Chianelli's "Air Scoop," page 15, we take a brief look at the tiny Garrett radio receiver, one of the many products pointing to ultra-miniature R/C. For the fun of it, we've also included an article on a wildly different type of R/C aircraft: the so-called flying "stop-rotor"; see page 62. This aircraft morphs mid-flight from helicopter to fixed-wing airplane. It captures the advantages of both rotor craft and fixed-wing airplanes while sidestepping the complexities and weight associated with many vertical takeoff and landing (VTOL) designs.

New materials, higher quality ARFs, easier to use computer technology, smaller electronics, higher capacity batteries and wildly innovative aircraft planforms all suggest that the future of our hobby will include some really exciting surprises. Will tiny backyard fliers capable of indoor IMAC-style aerobatic competition be a coming trend? Will unconventional rotor craft like the Area 51 Roswell (to be reviewed in an upcoming issue) be married to conventional planforms to produce new types of model VTOL aircraft? It's anybody's guess. As emerging trends define themselves, we will be there to bring you the latest.

Another highlight this issue is our coverage of the 1999 Top Gun Invitational, one of the most colorful and prestigious scale competitions in the world. Many new aircraft, more turbines, and even an electric participated; see page 30.

SEEKING OLD ISSUES OF *MODEL AIRPLANE NEWS*

Air Age Publishing is interested in acquiring additional back issues of *Model Airplane News* to further supplement our archives. We are particularly interested in obtaining copies of the first issue, published in July 1929, and we will consider purchasing partial collections. Interested parties, please contact us by mail at MAN Issue Archives, c/o Air Age Publishing, 100 East Ridge, Ridgefield, CT 06877-4606 USA; fax (203) 431-3000, or via email to man@airage.com.

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column you'll find new things that will at times cause consternation, and telepathic insults will probaly be launched in my general direction! But who cares? It's you the reader who matters most! I spy for those who fly!

AIR SCOOP

BY CHRIS CHIANELLI

Ki-61 Mini Combat Foamie

Every once in a while, a product comes along that defines a new way for us to enjoy our great hobby. The Ki-61 Hein from Dave's Aircraft Works is just such a model. Designed specifically to withstand the rigors of bungee launches, the Hein mini-foamie is made from the tough, revolutionary EPP foam, and this also makes the Ki-61 resilient enough to handle combat slope. The Hein is wildly maneuverable and a total blast to fly, according to its manufacturer. Because of its diminutive size, it can be launched and flown in small areas like schoolyards. An A-36 Apache and Mini Me-109E are also available.

Dave's Aircraft Works, 34455 Camino El Molino, Capistrano Beach, CA 92624; (949) 248-2773.

BALSACRAFT Spitfire

The sleek Spit joins Balsacraft's all-wood, compact series of kits. The light wing loading and size of the Spit make it well-suited to small flying sites. Like others in the Balsacraft line, the Spit kit includes competition-grade balsa and die-cut, interlocking parts for a strong, light and true airframe that's fully sheeted. While the kit is designed for electric power, the instructions show .15 to .20 glow-power conversion. The kit includes labeled parts for easy construction, molded plastic parts including pilot figure, and hardware package. Specs: wingspan—48 inches; area—418 square inches; weight—52 ounces; wing loading—17.93 ounces per square foot; power requirements—Speed 400 electric, .15 to .20 2-stroke, or .26 4-stroke glow.

Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; website: www.greatplanes.com.

BRISON 32S2

Thought you guys would like to see Brison's beautiful new 3.2ci (52.32cc) gas ignition engine. Brison states that the engine is suited for models weighing between 15 and 26 pounds, depending on wing loading, of course, and a few of the recommended prop sizes are 20x12, 22x8 and 22x10. Some of the features are: Nikasil-plated cylinder liner, Makita/Dolmer piston assembly, 4340-steel cantilever crankshaft, Walbro carburetor with smoke tap, blue-anodized case with sand-blasted cylinder, mechanical spark advance with CH electronic ignition and down-draft smoke muffler. Oh yes, I almost forgot: Brison offers a 2-year, one-time crash warranty on the crankshaft. Watch for more displacement offerings in Brison's single-cylinder gas engine line.

Brison Aircraft, 12075 Denton Dr., #11, Dallas, TX 75234; (972) 241-9152; fax (972) 241-5065.

Vintage ARF

This beautiful Fokker D-V has been added to the WW I vintage lineup offered by 3 Sea Bees Models. The model is 1/5-scale and comes all built, covered and painted, just as shown here. It's ready for any .45- to .60-size 2-stroke, or .53 to .65 4-stroke engine. According to 3 Sea Bees, an O.S. .46 proved more than adequate on the prototype. The rudder, elevator and ailerons are controlled with installed pull/pull wire systems, plus, all rigging is prefabricated. Specs: wingspan—68.9 inches; length—47.6 inches; weight—9.24 pounds.

3 Sea Bees Models, P.O. Box 747, Lake Stevens, WA 98258; (425) 334-6089; fax (425) 397-2126.

BACK-LOT Barnstormer

Joining House of Balsa's Schoolyard Scale series is this .061- to .10-size Super Decathlon. With its high-performance, semisymmetrical wing and fourth-channel aileron control, this little Citabria will do every maneuver in the book. The kit features all-balsa-and-ply construction, laser-cut parts, easy to follow, photo-illustrated instructions, full-size rolled plans, preformed aluminum landing gear and laser-cut tail feathers and fuselage sides. Specs: wingspan—47 inches; area—329 square inches; weight—24 ounces; wing loading—10.5 ounces per square foot; radio 2- to 4-channel with microservos. Rumor has it the price is right.

House of Balsa Inc., 10101 Yucca Rd., Adelanto, CA 92301; (760) 246-6462; fax (760) 246-8769.

Caliber 60 MEGA MACHINE

Kyosho's awesome new Caliber is a no-holds-barred, pure competition machine for the serious heli pilot whose "prime directive" is precision aerobatic performance. In short, the Caliber signals Kyosho's entry into the all-out competition market. From its ridged, precision-milled "ladder frame" to its 2-stage drive reduction, everything about the Caliber is designed to deliver efficient, low-vibration operation. For example, all parts on the straight-through, spindle-shaft rotor head are machined from A2017 aluminum, and the collective is controlled via a rising/falling swashplate operated by electronically mixed collective and cyclic. All high-strength belts run on machined-aluminum pulleys, and all servo placement is designed to provide straight-run linkages for super positive control. Even the fiberglass body is reinforced with carbon fiber. It appears that Kyosho's philosophy concerning the Caliber is "No compromises anywhere."

Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; website: www.greatplanes.com.

O.S. LA Large

O.S. now offers a .65 displacement engine in its budget "LA" line. While this is the most powerful engine in the series, it retains the great LA price and features such as reinforced crank-case webbing in high-stress areas, an extra-long crankshaft that offers more threads for the prop and spinner, and a remote needle valve for improved safety during adjustment. New for the .65 is the metal remote needle-mounting plate and 60A carburetor with hex-head air-bleed screw adjustment.

Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; website: www.greatplanes.com.

Volz!

SERVOS FROM GERMANY

For more than 15 years, Volz Modellbau (a model company) has been an innovator in servo technology. Volz states, "Our servos have been constructed and designed by experts using the best available components, so it is not only the color that makes them different." Volz's innovations include the Zip servo, "... the first with detachable lug mounts and snap-in frame," the Micro-Maxx, "... the fastest and most powerful microservo" and the revolutionary 10mm (0.39 inch) servos called the Wing-Star and Wing-Maxx, which are made exclusively for use inside wings and rudders. Currently, Volz has no exclusive American distributor for its line of highly specialized servos, but I, for one, sure wish they did. Interested distributors should contact: Volz Servos, Lilistrasse 83c, D-63067 Offenbach am Main; phone: +49 (0) 69-88 70 70; fax +49 (0) 69-88 76 35; email: info@volz-servos.com.

READY OVERNIGHT!

Designed for intermediate and advanced pilots, Cermark's new Bobcat 40 can be readied for the flightline in just one evening. The Bobcat's long list of prefabrications includes Ultracote covering, installed Thunder Tiger GP .42, installed tank with color-coded plumbing, hinge slots machined in control surfaces, three servos installed in the fuselage (JR-, Hitec-, Futaba-J- and Airtronics "Z"-compatible), and installed pushrods, spinner and wing hold-down bolts. All you have to do is join the wing halves, install the aileron servo (included), screw in the main gear and hook up your receiver. This kit is so complete, even a Master Airscrew prop is included. Specs: wingspan—57 inches; wing area—584 square inches; weight—5.4 pounds. Rumor has it that the Bobcat will hit the street for around $300. If your time is worth anything at all, that's a steal.

Cermark Co. Inc., 107 Edward Ave., Fullerton, CA 92833; (714) 680-5888/9; fax (714) 680-5880.

Eligo *Hand-launch*

HAVE IT YOUR WAY

Eligo is a unique solution to the aerodynamic peculiarities of a hand-launch sailplane. After extensive testing, its superior performance was achieved by using a sickle-shaped wing. And the best way to consistently produce Eligo's specialized, contest-winning wing is to mold it in foam. The computer-designed wing is made of light, hard foam with a glued-in double spar. The fuselage is of epoxy/glass, and the nose is a plug-in type. The kit is very simple; only two channels (rudder and elevator) are required, and it can be completed in a few hours. Included in the kit are materials and instructions for both standard fin/stab or V-tail-style tail group; it's your choice. Specs are: wingspan—56 inches; wing area—311 square inches; flying weight—10 ounces; wing loading—4.7 ounces per square foot.

Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.

Indoor Micro Receiver

Believe it or not, this 1x½-inch micro receiver (SHR-RX72) is a fully proportional, 72MHz, FM 4-channel unit that weighs only 2.4 grams, including antenna, connector sockets and crystal. Its range is 600 feet, and it's compatible with JR, Airtronics, Multiplex, Hitec and Futaba radios. But wait! The model SHR-RX72-PRO (solder terminals) is a 5-channel receiver with dimensions of 0.8x0.525 inch, and it's even a little lighter—believe it or not.

Sky Hooks & Rigging, 2206 Towne Blvd., Oakville, Ontario, Canada; (905) 257-2101; fax (905) 257-0168.

FLY THE R/C CAN CONTEST!

By now, I'm sure most of you have seen the B.C. Air Originals "Best Plane" contest in which you can win $1,000, $200 or $50 (and a trophy) by sending in a picture of the airplane you've built from a soda or beer can. If you haven't already seen the ad, take a

look at it in this issue; the official rules are all there. I would like to take this contest a few steps farther: the first person who builds an R/C airplane out of aluminum cans and sends me a video of a successful flight (that is, controlled flight for more than 100 yards) will receive a 5-year subscription to *Model Airplane News*. Rumor has it that a successful control-line model made from soda-can aluminum has already been built—so what are you waiting for?

AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," MODEL AIRPLANE NEWS, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

GRASSROOTS

I really enjoyed Vance Mosher's "Grassroots" article, "Warbirds over Washougal." I think that out here in the real modeling world, people build smaller scale warbirds. I know I do, and when I see aircraft like the ones pictured in his article, it gets me way more excited than seeing some of the gigantic scale planes that I have no interest in.

I build 1/7-scale warbirds (probably a holdover from the days when my brother and I collected every known plastic model in 1/72 scale and hung them from the ceiling). I currently have a scratch-built P-51, am just finishing a Top Flight P-51 (for my dad) and have a Royal F8F Bearcat, a Royal Zero, an old Top Flight P-39, a scratch-built Macchi 72 race plane and a Top Flight P-40 —all in 1/7 scale. With all those airplanes, I still haven't been able to find one of my favorite fighters in 1/7 scale. Vance's Corsair, with its 72-inch span, appears not only to be 1/7 scale but also beautifully done! Was it built from plans or a kit? And could you let me know which kit or plan? Thanks for the excellent article. [email] DAN LOVELESS

Dan, the Corsair is an old GM Plastics kit, vintage 1988. I believe they were in Grand Rapids, MI. The model weighs 16 pounds, so it isn't small, and it has a SuperTigre 2500 and Century Jet retracts. The paint scheme is authentic; it is one of the background airplanes in a well-known photo of an echelon led by super ace Lt. J.G. Ira Kepford, USN. I chose it because it has the three-color scheme and the red outlined insignia that add a lot to its appearance.

The airplane is very stable and easy to fly, and the full flaps work to slow down landings really well. Corsairs fly kind of like expensive pickup trucks. Bob Holman Plans [P.O. Box 741, San Bernardino, CA 92402; (909) 885-3959] offers fairly inexpensive plans for an 84-inch Corsair. You could buy them and reduce them to any size you like at the local print shop.

Vance Mosher

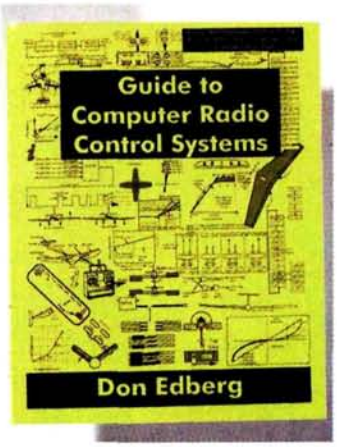
ARF FAN

I have been reading *Model Airplane News* since 1956. Chris Chianelli's article about the Spacewalker prompted me to purchase one. I have an old Enya 120 4C to put in it. On my kit, the covering is very slack. Was his the same? The hinge slots did not line up on mine. Did he fuelproof the inside of the fuse? Mine was bare, and I coated it with finishing epoxy.

I usually build from plans, so ARFs are not my forte, but this one seems to be very good. I built the Kyosho 232, and this Spacewalker seems to be from the same manufacturer.

It is almost impossible to build to the level of quality and price that the new breed of ARFs offer. I am in the hobby because I love planes and build those that truly are appealing. ARFs, for me, represent very good value and allow me to get airborne quickly. I will always scratch-build because I love it, but will also have ARFs to round out my stable of weekly fliers. [email]

LOU MELANCON



Lou, though the specs recommend a .91 4-stroke, I think a good 1.20 such as the Enya 1.20 4C is perfect for the Spacewalker—not quite as powerful as the Enya 1.20 R, but it still has plenty of torque and will last almost forever if you care for it properly. On high-G maneuvers, the carburetor on my 4C did have minor draw problems. This will be cured if you mount a Varsane Products Perry oscillating pump off the front of the crankcase, diametrically opposed to the cylinder. I did this with my 1.20 4C, and it worked like a charm from then on. Pumps seem to help out most 4-strokers.

My Spacewalker did initially have some wrinkles, but overall, it wasn't bad. After a few times at the flying field, temperature changes had caused some very obvious covering slackening, but it came right out with a hit of the heat gun. I didn't mention this in the article because I'm used to this with MonoKote. Oracover and Ultracote don't seem to slacken quite as much.

All the hinge slots lined up perfectly on my model, and it did have the firewall, tank compartment and F2 former sealed with epoxy. I did apply epoxy to the wing saddle to seal the MonoKote seam down. I've never been one to seal radio compartments ... maybe I should.

You're right, Lou; today's ARFs certainly represent fantastic value. If your time is worth anything at all, they're a bargain for sure.

Don't forget to have fun! CC

ALPHABET SOUP

I know what AM, FM and PCM mean, but I don't have a clear idea about how PPM works. Some guys at the field told me that PPM is the same as FM, or something like that, but of course, that is not an explanation. I have a Futaba 7UAP with only one receiver for four airplanes, and if there's a way to turn the transmission from PCM to FM and vice versa, I don't know it. PCM receivers are expensive, and I would like to install FM receivers in my remaining three birds. Is it possible to do that? [email]

FEDERICO CAMPOS

Federico, we forwarded your question to our "Effective Programming" columnist Don Edberg, and here's what he had to say:

OK; the answer is yes. Here's a quick explanation: FM stands for frequency modulation and is a transmission scheme in which the frequency of the radio signal changes back and forth to send information. There are two types of R/C receivers: pulse position modulation (PPM—sometimes referred to as "FM") and pulse code modulation (PCM). Interestingly, both use FM to encode their information; the difference is that PPM transmits the transmitter's stick positions by varying the signal length while PCM directly sends a digitally encoded number. PCM transforms stick positions into ones and zeros, and this is where the term "1024" comes from (1,024 possible positions between full throw from side to side for each channel).

Changing your transmission method is usually very simple. On a computer radio, there's a command that specifies which type of transmission is to be used. All you need to do is select the PPM choice, and you're ready. I hope that this answers your question. Don E.

Editors' note: for more specific information on this and other radio questions, check out Don's book, "Programming the Futaba Super 7 Radio System for Aircraft and Sailplanes," and "Guide to Computer Radio Systems" on the web at www.flash.net/~dynamic3, or call (949) 552-1812 or (888) 770-1812 (orders only).

ERRATA

In Chris Chianelli and Dave Gierke's "Airframes and Prop Selection" article in the July '99 issue, we inadvertently misprinted an equation on page 42. The "propeller load factor" is really $Lprop = D^2(P)$.

In the June '99 Index of Manufacturers, we provided an incorrect address for Maxx Products. They can be reached at 815 Oakwood Rd., Unit D, Lake Zurich, IL 60047; (847) 438-2233; fax (847) 438-2928.

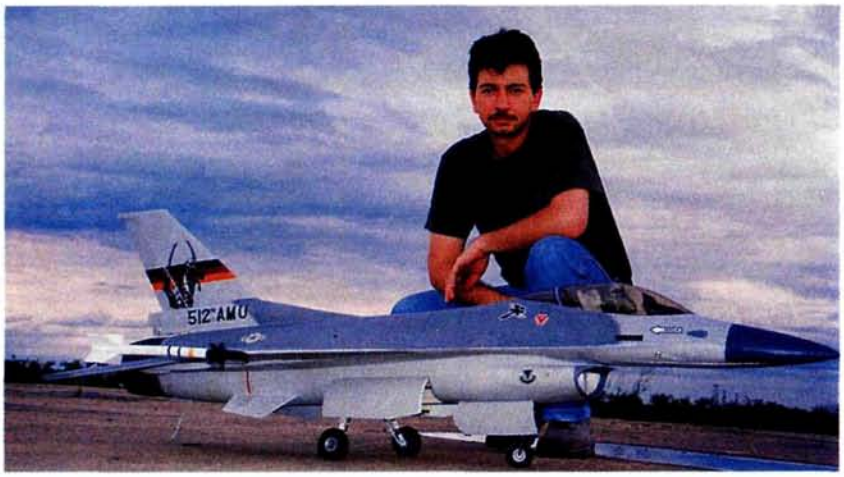
PILOT PROJECTS

A look at what our readers are doing

SEND IN YOUR SNAPSHOTS. ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.



FOAM FALCON

Bolivian Victor Hamdan, now of Tartagal, Argentina, shares with us his .61 Magnum-powered Combat Models F-16N. The all-foam structure is reinforced with carbon fiber and fiberglass covering. Victor made the graphics by enlarging a set of plastic model decals on his PC. He further enhanced his 8-month building project with Robart retracts, landing lights and a movable pilot in the scale cockpit. Control is provided by a Futaba 8UAF radio.

TEXAS LIGHTNING

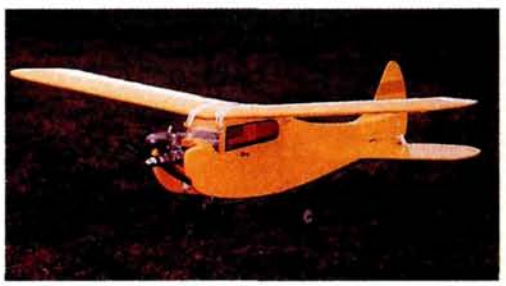
Art Wagner of Prosper, TX, sent us this photo of his completed Wing Mfg. P-38J. Counter-rotating O.S. .46s with the assistance of PA-104 fuel pumps power the 70-inch-span twin. The Airtronics Stylus-controlled craft uses nine servos as well as a piezo gyro unit. A 2-year-long building project, it's detailed with Robart wheels and struts, Spring Air retracts and homemade "mostly in-cowl" mufflers. Art tells us his 15-year-old son Kurt really enjoys the model and that it's very easy to fly and land!

STERLING EFFORT

This silver masterpiece is from the workshop of Nick Christopher in Williamstown, NJ. Nick started out with the 86-inch-span Dynaflite PT-19 kit, then scratch-built the landing gear and the two windscreens. Rivets provide another scale accent to the 13-pound plane. Power comes from an O.S. 1.08, and the metallic finish is Sig Koverall, Sig Dope and 21st Century paint. Jim Stow, who sent in the photos, says his friend's Futaba-controlled aircraft flies beautifully, and 3-point landings are a breeze.

STUNT STRADIVARIUS

Mort Tyler of Orinda, CA, has seen flying lawn mowers, witches and doghouses, but his quest for something even more extraordinary resulted in "The Flying Fiddle Faddle." He hasn't had any problems tuning his O.S. .20-powered ensemble; the key to it is practice, practice, practice! Mort can be heard flying with his band of Diablo Valley R/C'ers in Antioch, CA.



TRIBUTE TRIXTER

Roger Russell of Jacksonville, IL, shared with us his fond memories of his late dad, Mark, and their Guillow's Trixter Beam. His dad had always wanted to outfit the '50s vintage aircraft with modern-day equipment. Friends Merle Menezes, Chuck McCormick and Jack Wahle helped Roger realize his—and his father's—dream. Roger extends his thanks to these friends for their generous efforts; the Irvine .25-powered 50-inch-span airplane flies well—just as Mark knew it would!

VOSS IS IT?

Here's a unique modeling subject from Al White of Superior, MT; this is a Blohm and Voss BV 141 B that Al scratch-built from a set of Nick Ziroli plans. The MonoKote-covered model carries an O.S. .46 LA for power, weighs 5½ pounds and has a wingspan of 55 inches. At the time the photo was taken, Al was waiting for the weather to warm up—and his pulse rate to go down—before flying the model for the first time.

MILLENNIUM MUSTANG

Las Vegas, NV, modeler Greg Minden tells us this sharp Balsa USA P-51 was one of the easiest to construct kits he has ever built. The Ultracote-covered Mustang took about six months to complete. Greg uses Robart retracts on the 13¾-pound airplane and powers it with a Bully 1.20; no word yet whether he'll be using his computer radios after the first of the year.

SUPER SOAKER

Pete Stankovich of McDonough, GA, scratch-built this balsa, ply and fiberglass design that he based loosely on the Canadair CL-415. The 84-inch-span water-bomber can either be filled on shore or can scoop water while skimming the lake. When the plane is filled to its 1-gallon capacity, it will wet a 7x40-square-foot area. Full-span flaps and spoilers assist with control when the model is loaded to its 19-pound limit. A Futaba 8UAF radio controls the 10 servos on board, and power is delivered by a pair of SuperTigre .45s with APC 11x5 propellers.

SHEBOYGAN BIPE

This Bücker Jungman is the wonderful work of Kurt Reinbacher of Sheboygan, WI. Kurt began with a 65.75-inch Carl Goldberg kit that he modified for the sake of strength. The model is covered with 21st Century fabric and trimmed with Top Flite LustreKote paint. The 11½-pound Jungman is powered by a 4-stroke Saito 1.50.

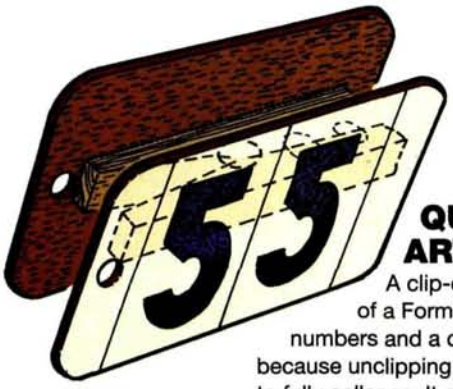
FILL 'ER UP?

If the folks at Texaco had ever owned a Waco Model 10, modeler David White of Essex, MA, is sure it would have looked something like this. His Ikon N'West model spans 74 inches and carries an O.S. 1.20 Surpass and Zinger 18x6 for power. The covering and wing-lettering material is 21st Century fabric, and a local sign company made the Texaco graphics.

HINTS & KINKS

BY JIM NEWMAN

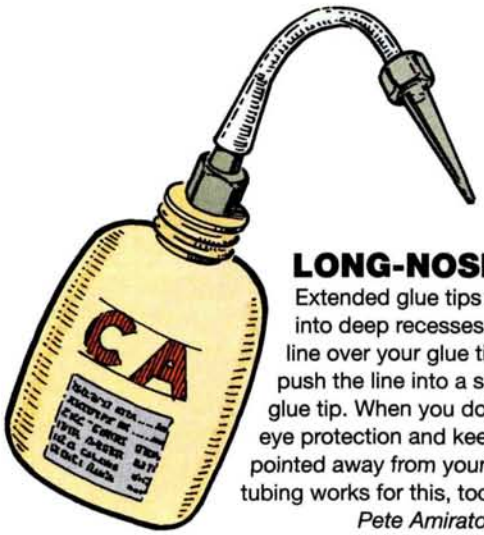
SEND IN YOUR IDEAS. Model Airplane News will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



QUICK-CHANGE ARTIST

A clip-on frequency flag made out of a Formica sample, stick-on vinyl numbers and a clothespin is convenient because unclipping the flag allows the antenna to fully collapse. It also allows you to quickly change flags, if you have a synthesized transmitter module and want to change channels.

Dave Kovensky, Albuquerque, NM



LONG-NOSE CA

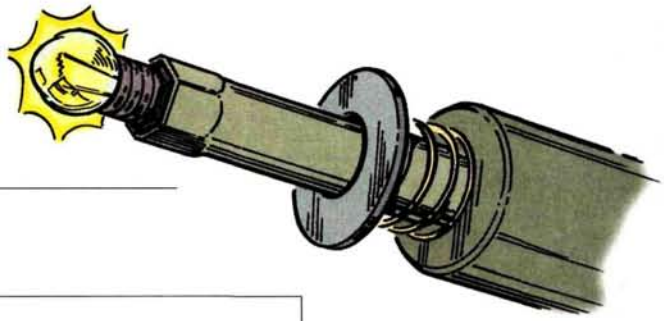
Extended glue tips can reach into deep recesses. Force fuel line over your glue tip, then tightly push the line into a spare plastic glue tip. When you do this, wear eye protection and keep the tip pointed away from your face. Nyrod tubing works for this, too.

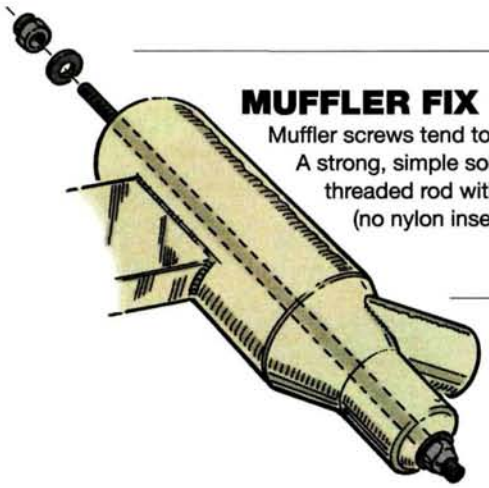
Pete Amirato, La Mesa, CA

BRIGHT IDEA

Cycle your glow-plug Ni-Cd, too. A Radio Shack no. 272-1174 prefocused bulb is rated at 1.2 volts and 250mAh and will take 3 to 4 hours to fully discharge a 1200mAh Ni-Cd cell. When the bulb is extinguished, the cell is ready to be recharged.

Chris Horne, Atlanta, GA





MUFFLER FIX

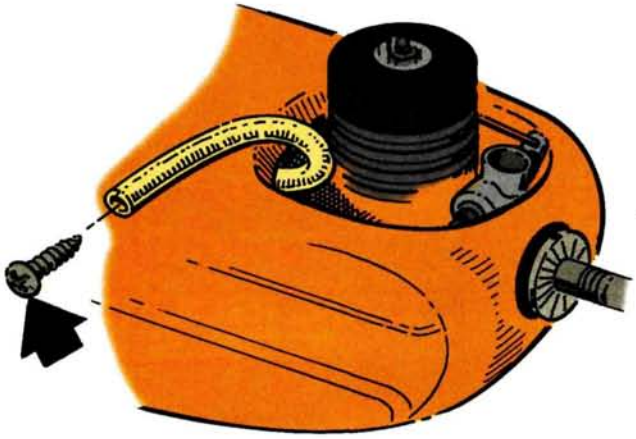
Muffler screws tend to be soft, and they break easily. A strong, simple solution to this is to use a length of threaded rod with a plain washer and an all-steel (no nylon insert) locknut on each end.

David Till, Fairhope, AL

BLUNT BLADE HOLDER

Don't throw your blunted knife blades in your shop trash can. Instead, push them through a small slit in the plastic cap of an empty CA "kicker" container or a large pill bottle. [Author's note: when my container is full, I pour the dregs of epoxy mixes onto the blades to safely encapsulate them ... a tip learned from this column.]

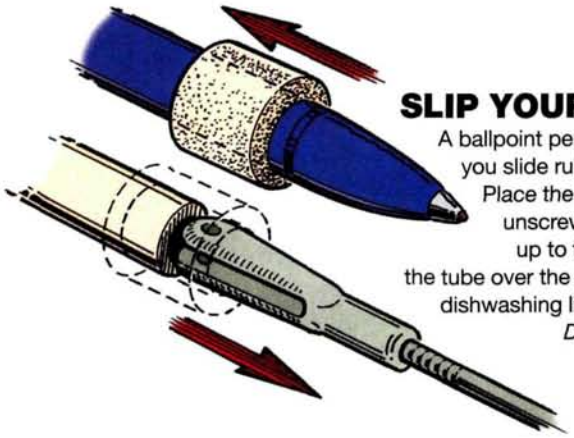
Randy Boyne, Berwick, LA



DO THE TWIST

If you lose the plug to your fuel tank filler tube, you can use a sheet metal or machine screw. As it is twisted into the fuel line, the threads will make a fuel-tight seal.

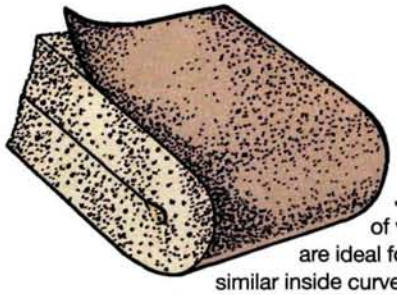
Chris Jacobsen, Murray, UT



SLIP YOUR BIC

A ballpoint pen is a useful aid when you slide rubber tubing over a clevis. Place the tubing onto the pen, unscrew the pen, butt the clevis up to the pen body, then slide the tube over the clevis. A smear of dishwashing liquid on the pen helps.

Dave Crisman, Banks, OR



A SOFT TOUCH

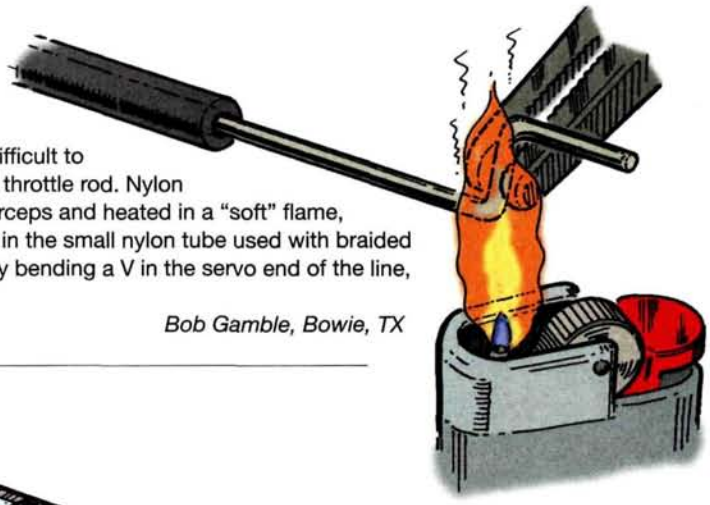
Jack makes sanders of various radiuses that are ideal for sanding fillets and similar inside curves. Fold and CA tack-glue various thicknesses of sponge foam, then fasten self-adhesive sandpaper to the pad.

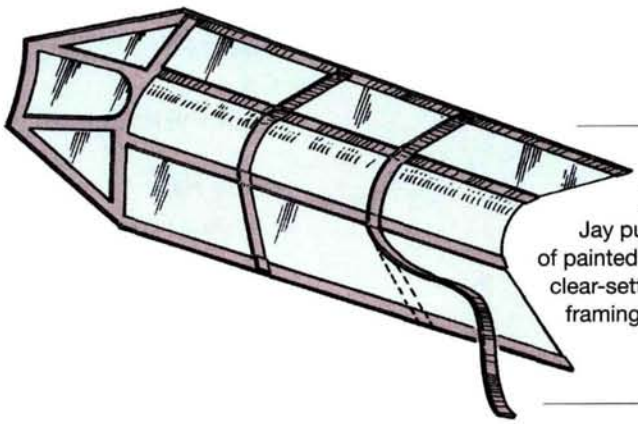
Jack Dundas, Ridgeville, Ontario, Canada

AN OLD FLAME

Cramped cowls in small models make it difficult to use a regular size Nyrod and clevis on the throttle rod. Nylon monofilament weedeater line, held with forceps and heated in a "soft" flame, can be formed to a Z-bend, then installed in the small nylon tube used with braided cable controls. Adjust the monofilament by bending a V in the servo end of the line, then open or close the V.

Bob Gamble, Bowie, TX

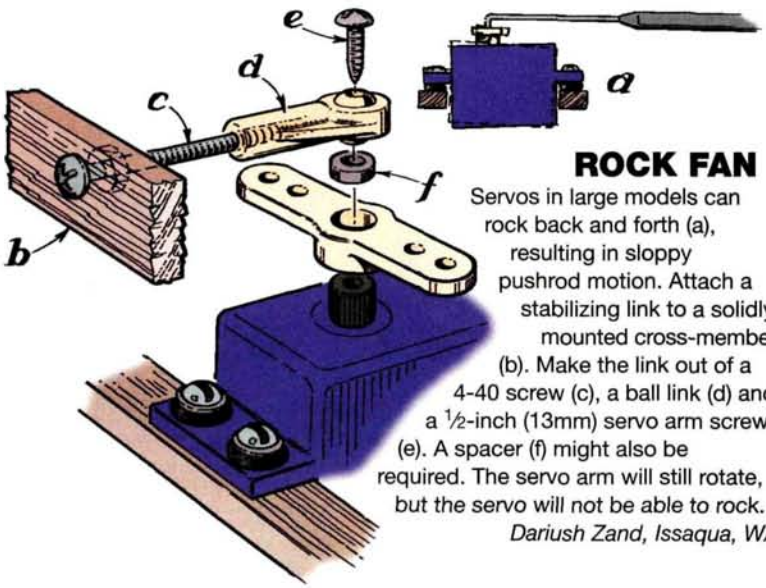




INSIDE INFORMATION

Jay puts his canopy framing on the inside. He cuts narrow strips of painted covering material, then glues the strips into place with a clear-setting canopy glue. The result is a sharp-edged, colored framing that you won't snag as you clean the model.

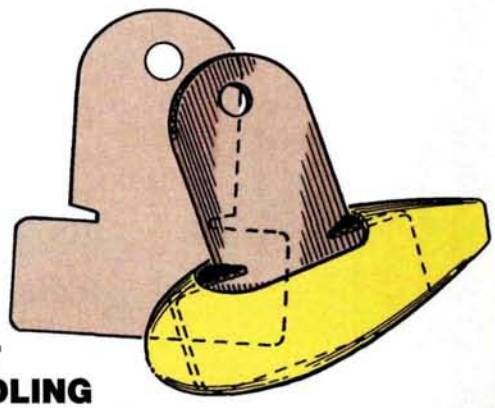
Jay Beery, Brownsburg, IN



ROCK FAN

Servos in large models can rock back and forth (a), resulting in sloppy pushrod motion. Attach a stabilizing link to a solidly mounted cross-member (b). Make the link out of a 4-40 screw (c), a ball link (d) and a ½-inch (13mm) servo arm screw (e). A spacer (f) might also be required. The servo arm will still rotate, but the servo will not be able to rock.

Dariush Zand, Issaqua, WA



PANT HANDLING

Cut this gadget out of corrugated cardboard, then jam it inside each wheel pant so that you have a useful handle while spray painting. The hole in the handle allows you to hang the pant up to dry.

Norman Franzino, Royal Palm Beach, FL

The 11th annual Top Gun Invitational, attended by thousands, was a grand spectacle; an opportunity to behold the finest technology *in scale modeling, and a* warm meeting place for those who have distinguished themselves in one of the most prestigious segments of the sport of radio control. The weather was sunny and warm, and the luxurious surroundings of the West Palm Beach Polo Grounds again gave this pinnacle of scale competition a sense of class and comfort rarely seen anywhere else in modeling.

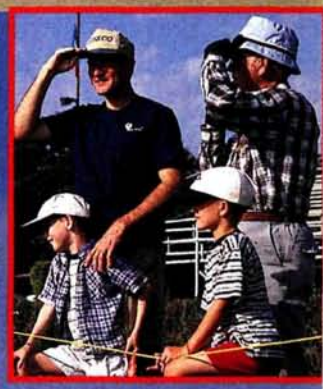
With many new aircraft being campaigned, this year's event was blessed with the lowest attrition rate in the event's history. Only four or five aircraft were unsalvageable, and there were no middairs.

On the runway, windless periods alternated with wind blowing directly down the runway—unusually favorable meteorological conditions, given the frequency of quartering winds and occasional rain at this site in the past.

Jeff Foley's 86-inch-span Bf 109E sports Platt landing gear, a Moki 1.8 swinging an 18x10 prop and a polyester resin and K&B paint finish.

Top GUN

by the Staff of
Model Airplane News



Built by Bill Stevick (owner of Bob Dively Models) and flown by Dino DiGiorgio, this 1/4-scale, 102-inch-span P-51D weighs 36 pounds and is powered by a 3W-802 engine. FiberClassics kit; dope finish.

This team scale T-34B was entered by Bob Boswell and Mark Frankel. The 1/4-scale model has a 99-inch wingspan and weighs 40 pounds. Moki 3.6; Zinger 22x10 prop; Robart gear; PPG paint.

John Chevalier scratch-built his 1/3-scale Ryan STM from Reese plans. 120-inch span; 36 pounds; Quadra 75; dope finish.

This team scale entry by Jim Hiller and Tad Krzanowski (owner of Golden West Models) is a scratch-built 1/7-scale MiG 17. JetCat turbine; 16 pounds; 53-inch span; acrylic lacquer finish.

Terry Nitsch won Expert and captured the coveted "Mr. Top Gun" title for a fourth time, this year with his immaculately finished 1/8-scale F-80C Shooting Star. The Bob Violett Models kit uses BVM gear and an AMT turbine for power; it's finished in Coverite Presto and paint.

Team entrants Ray LeBonte and Peter Flanagan took home 4th place with this 1/5-scale Harvard Mk IV. Yellow Aircraft kit; automotive lacquer finish; Sachs 4.2; 101-inch span; 38 pounds.




Top GUN SCORES

EXPERT CLASS

POS.	PILOT	SCALE/MODEL	PLANS/KIT	ENGINE/FUEL	RADIO	GEAR	STATIC SCORE	TOTAL SCORE
1	Terry Nitsch	1/8 F-80C	BVM	AMT/Jet A	JR	BVM	96.667	192.792
2	Phil Sibille	1/3 Super Cub	NA	O.S. 300/Wildcat	JR	NA	96.083	188.250
3	Stephan Duerrstein	1/9 JU-52	FiberClassic	Laser 70/German	Multiplex	NA	94.667	188.084
4	Tommy Wood	1/7 F-15C	Air Magic	Ram 750/Jet-A	JR	Rhom-Air	93.667	185.584
5	Kim Foster	1/4 Sopwith Pup	Reeves	Laser 200/Omega	Futaba	NA	96.750	184.583
6	Mike Winter	1/3 Sopwith Pup	Balsa USA	Sachs 4.2/Gas	Futaba	NA	93.500	184.583
7	Corvin Miller	1/6 F4U Corsair	Ziroli	Saito 450/Wildcat	Airtronics	Robart	93.167	184.209
8	Jack Diaz	1/8 F4B Phantom II	BVM	AMT/Jet-A	Graupner	BVM	91.500	181.250
9	Gary Bussell	1/8 Spitfire MK-14C	Yellow	G-38/Shell 87	Futaba	Yellow	92.917	180.625
10	Mike Barbee	1/3 WACO YMF-5	BMA	125cc MM/Gas	Futaba	NA	93.750	180.375
11	Lee Rice	1/7 F4U Corsair	Taylor	O.S. 1.08/C.Pwr	Airtronics	Aune	93.333	179.583
12	René Alvarez	1/9 F-80	BVM	BVM 91/Wildcat	JR	BVM	93.000	179.208
13	Jim Wilkinson	1/4.6 FW-190A8	Don Smith	O.S.300/Wildcat	Futaba	Self	94.500	179.042
14	John Chevalier	1/3 Ryan STM	F. Reese	Q-75/Gas	Futaba	NA	92.083	179.041
15	Al Kretz	1/5 Spitfire	Yellow	Moki 1.8/Omega	Futaba	Yellow	90.583	178.958
16	Ernie Harwood	1/4 Fokker D-VII	Proctor	Laser 200/P.Mstr	JR	NA	96.250	178.875
17	Greg Hahn	1/5 SBD Dauntless	Ziroli	G-445/Shell	JR	Robart	95.750	178.833
18	David Voglund	1/5 P-51D	Aerotech	Moki 1.8/Omega	JR	C.Jet	93.083	178.833
19	Robert Benjamin	1/4 Taylorcraft	NA	Astro 90/Battery	Airtronics	NA	92.667	178.459
20	Gustav Campana	1/6 F-86	FiberClassic	Ram 750/Jet A	Futaba	Rhom-Air	90.167	174.625
21	Joe Denicola	1/6 Skyraider	Ziroli	3W-60/Gas	Futaba	Likes	88.333	170.333
22	Bill Killam	1/4 Fokker D-VII	M. Bealius	G-62/Gas	Futaba	NA	89.667	169.667
23	Ray Kleber	1/6 Skyraider	Ziroli	G-62Amoco	Futaba	Robart	87.250	161.500
24	Manny Sousa	1/6 Skyrocket	F. Coulson	ASP 1.08/Morgan	Airtronics	CJM	88.917	160.292
25	Frankie Mirandes	1/6 P-80A	BVM	BVM 91/Wildcat	JR	BVM	88.583	104.666
26	Kent Nogy	1/8 F-4J Phantom	BVM	BVM 96/Wildcat	JR	BVM	93.667	093.667
27	Paul McCauley	1/5 Beaver	FiberClassic	3W-48/Gas	Futaba	NA	89.500	091.917
28	Clark Hopkins	1/3 Extra 300	German	G-62/Gas	Futaba	NA	91.667	091.667
29	Rich Uravitch	1/5 P-47	Ziroli	Sachs 5.2/Gas	Futaba	Robart	91.583	091.583
30	Bob Benson	1/5 T-34C	R. Torres	Moki 1.8/Sig-Fai	Futaba	Robart	89.833	089.833
31	Tom Cook	1/6 T-33	JMP/T.Cook	AMT/Jet-A	Futaba	JMP	00.000	000.000

DESIGNER CLASS

POS.	PILOT	SCALE/MODEL	PLANS/KIT	ENGINE/FUEL	RADIO	GEAR	STATIC SCORE	TOTAL SCORE
1	Jeff Foley	1/4.5 BF-109	NA	Moki 1.8 Omega	JR	Platt	95.250	187.458
2	Ramon Torres	1/5 T-34C-1	NA	YS 1.40/Sig	Futaba	Self	91.250	185.625
3	Charlie Nelson	1/4 YKS-7 WACO	NA	Seidel 7/R-max	Airtronics	NA	95.500	185.542
4	David Ribbe	1/7 MiG 15	NA	JPX/Propane	JR	BVM	91.917	185.292
5	Tom Polapink	1/4 Pfalz D-IIIA	NA	Moki 1.8/Cool Power	Airtronics	Self	96.750	184.750
6	Gerard Rutten	1/5.5 Beech C-45	NA	Saito 90/Wildcat	Futaba	NA	93.333	183.333
7	Tom Kosewski	1/4 Fokker EV	NA	Q-35/Gas	Airtronics	NA	97.250	182.125
8	Bob Underwood	1/6.7 IL2M3	NA	K&B 100/K&B 500	Airtronics	Robart	91.083	181.000
9	Bud Roane	1/4 Sopwith Triplane	NA	Saito 1.50/Red Max	Futaba	NA	92.750	180.417
10	Pavel Fencl	1/4.3 Spad VII	NA	Sup.Tiger2500/Own	Futaba	NA	96.917	179.000
11	David Hayes	1/7 Ayres Thrust	NA	RCV 1.20/Omega	JR	NA	90.417	177.042
12	Richard Feroldi	1/3 Airco DH2	NA	Sachs 4.2/Exxon	Futaba	NA	94.417	176.625
13	Art Johnson	1/6 F-82G	NA	O.S. 1.08/Byron	Futaba	Self	90.083	175.916
14	David Fogarty	1/4 Curtiss Junior	NA	Moki 1.8/Wildcat	Futaba	Self	88.250	153.708
15	Sepp Uiberlacher	1/5 Spitfire Mk16	NA	ST 2500/Wildcat	Futaba	Self	96.500	151.917
16	Hal Parenti	1/6.5 Ryan Fireball	NA	OS.46 WB 1.2/Self	Airtronics	Robart	91.500	151.583
17	Kerry Sterner	1/5 DH100 Vampire	NA	Ram 750/Jet-A	Airtronics	Rhom-Air	88.917	109.042
18	Pat McCurry	1/5 Dornier 335	NA	Moki 1.8/Wildcat	JR	Self	97.833	099.833
19	David Platt	1/6 T-28	NA	Platt 1.75/Wildcat	Ace	Platt	93.583	098.833

TEAM CLASS

POS.	PILOT	SCALE/MODEL	PLANS/KIT	ENGINE/FUEL	RADIO	GEAR	STATIC SCORE	TOTAL SCORE
1	McCallie/Berton	1/6 A6M3 Zero	D.Platt	3W-70/Gas	JR	C.Jet	96.167	189.959
2	Violett/Caudle	1/6.5 TV-1	BVM	Ram/Jet Fuel	JR	BVM	96.583	189.958
3	Ziroli Jr./Steffes	1/4 SNJ-5	126% Ziroli	Q-100/Gas	Airtronics	Barton	97.500	189.375
4	Labonte/Flanagan	1/6 Harvard Mk. IV	Yellow	Sachs 4.2/Gas	Futaba	Yellow	96.250	188.543
5	Elias/Richardson	1/6 MiG 15	NA	AMT Merc/Kero	Futaba	BVM	94.083	187.833
6	Fuori/Tozser	1/6 B-25	Ziroli +21%	G-38/Gas	Futaba	Robart	99.083	187.541
7	Boswell/Frankel	1/4 T-34	NA	Moki 3.6/Omega	Futaba	Robart	95.167	187.417
8	Pinegar/Alfafara	1/4 Clipped Cub	M.Gretz	O.S.160/Byron	Futaba	NA	95.917	186.875
9	Shulman/Valdez	1/6.5 TV-1	BVM	BVM 91/Wildcat	JR	BVM	92.917	185.084
10	Patrick/Mears	1/3 Tiger Moth	Beard	Moki 3.6/Gas	Futaba	NA	98.333	184.916
11	Chambers/Tiano	1/7 MiG 15	BVM	Ram 750/Jet-A	Airtronics	BVM	93.750	184.792
12	Di Giorgio/Stevik	1/4 P-51D	FiberClassic	3W-802/Mobil	JR	FiberClassic	93.500	184.125
13	Hiller/Krzanowski	1/7 MiG 17	Tad	Jet Cat/Jet-A	JR	BVM/Own	91.333	181.250
14	Breen/Donofrio	1/4 WACO YKS-6	Scratch	B&D/Byron	Futaba	NA	94.063	178.791
15	Dodgen/Snyder	1/7 MiG 15bis	NA	Ram 750/JP-4	JR PCM	BVM	96.750	177.708
16	Gutierrez/Surco	1/3 Extra 300S	TNT Models	Zenoah 445/Gas	Futaba	NA	93.667	172.959
17	Patton/Floyd	1/5 MiG 15	Century Jet	Ram 750/Jet-A	JR	Century Jet	91.633	151.833
18	Sandquist/Siewert	1/8 P-47	Aerotech	Brison 4.2/Gas	Futaba	Robart	95.750	142.792
19	Gonzalez/Araujo	1/7 F-15	Mueller/Ram	Ram 750/Jet-A	Airtronics	Airmag	93.167	93.167
20	Reid/Gillispie	1/6 Panther F9F	Ziroli/Aero.Works	O.S. 91/Omega	Futaba	Century Jet	92.833	92.833

TECH TALK

RADIOS

Futaba	31
JR	18
Airtronics	12
Ace1	
Graupner	1
Multiplex	1

ENGINE TYPE

Props	49
Turbine	11
Ducted fan	4

ENGINES

Moki	9
O.S.	6
Zenoah	6
RAM	5
AMT	4
3W	4
BVM	4
Sachs	4
Laser	3
Saito	3
Quadra	3
SuperTigre	2
ASP	1
Astro	1
B&D	1
Jet Cat	1
JPX	1
K&B	1
MM	1
Platt	1
RCV	1
Seidel	1
YS	1

FUEL

Gasoline	17
Wildcat	12
Jet A	10
Omega	6
Cool Power	4
Byron	3
Own	2
Red Max	2
Sig 2	
Battery	1
German	1
K&B	1
Morgan	1
Propane	1
Power Master	1

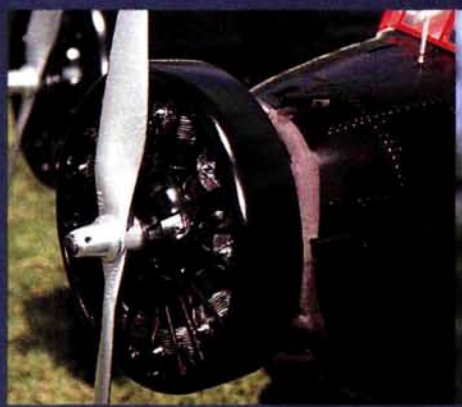
Top: Phil Sibille built this 1/3-scale Super Cub and powers it with an O.S. 300 engine with a Zinger 22x8 prop. Scale Stitts covering; 144-inch-span; 37 pounds. Middle: Bill Steffes built this detailed, 1/4-scale SNJ from enlarged Ziroli plans, and Nick Ziroli Jr. piloted the 10-foot-plus-span model to third place in Team. The model weighs 50 pounds and is powered by a Quadra 100 engine. Below: Bill McCallie and Ed Berton won Team class with this 1/5-scale Zero M3 Hamp built from Dave Platt plans. The 91.5-inch-span plane is powered by an SW 70cc engine turning a 22x12 prop, and it's finished with Hobby Poxy.

There were many moving models, but one in particular—a 75-pound, 1/5-scale Dornier 335—captured the attention of all. When this magnificent craft, built by Pat McCurry and sporting a propeller at each end, began its takeoff roll, every single person in the pit area clambered to the flightline perimeter to observe the flight. In the middle of its first attempt, the flightline coordinator called a change in wind direction, and this aborted the takeoff attempt. The plane was stopped, and the pilot turned it around to try another takeoff. Then, with no headwind at all and with the field windsocks limp, the plane accelerated across the grass. Some noticed that the nose gear seemed to be pressing into the grass. The plane lifted off but shortly returned to earth and crashed, and the crowd across the Polo Grounds roared a groan. The inside word is that, in the positive spirit that typifies the attitude of serious modelers, a new one will be built for next year's competition.

Late in the meet, when organizer Frank Tiano called a vote to determine whether to change venues in the future, the pilots decided to keep Top Gun at the Polo Grounds even though a large cellular tower is to be built behind the scoreboard at one end of the field.

If the trend continues, next year's event will be even more spectacular than this year's. This year, 11 turbine jet-powered aircraft competed, compared to just four last year. Moreover, Palm Beach Polo Grounds authorities reported that

Continued on page 38



Stephan Duerrstein flew his huge, 1/3-scale Junkers Ju-52 to third place in Expert. Powered by Laser 70 engines, the 128-inch-span model is finished with automotive paints and is guided by a Multiplex radio.

Top GUN

This 1/3-scale WACO YMF-5 is the handiwork of Mike Barbee, who finished the 110-inch-span plane in Scale Stitts covering with automotive paint. This beautiful bipe won Best Civilian Aircraft.

Designed and built by Paul Donofrio and flown by Mike Breen in Team, this 1/4-scale WACO YKS-6 has a 99-inch wingspan and uses a B&D engine for power. The 35-pound plane is finished in dope.

Charlie Nelson's 1/4-scale WACO YKS-7 is powered by a Seidel 7 engine swinging a Zinger 22x10 prop. It has a 93-inch span and is finished with Scale Stitts.

David Hayes' Ayres Thrush was the only model at Top Gun that was powered by the new RCV 1.20, an engine that has a rotary cylinder valve. The 15-pound crop-duster has an 83-inch span and is covered in fiberglass with K&B paint. During its scored flights, the model actually "dusted" the polo field.

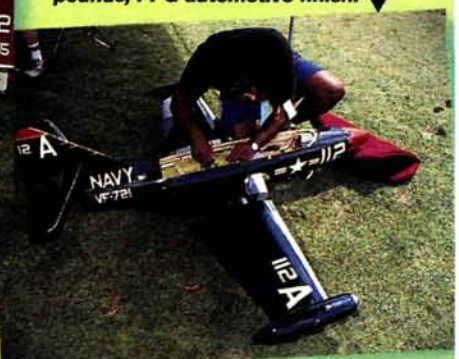
***Herschel Worthy (left) of Pacer Inc., Frank Tiano of FTE Enterprises and Tom Atwood, group editor-in-chief of* Model Airplane News.**

We would like to acknowledge the important contributions that Herschel Worthy of Pacer Inc., manufacturer of ZAP glues and related products, and Frank Tiano, organizer of Top Gun, have made to the R/C sport through their steadfast support of Top Gun since its inception in 1989. In the last decade, contributions from Pacer for items ranging from cash awards to cocktail receptions, trophies, exhibitor tent rentals, contestants' hats, shirts, etc., have exceeded $100,000! Meantime, Frank Tiano has tirelessly orchestrated Top Gun behind the scenes to make it the pinnacle of scale-modeling competition. Other co-sponsors and contestants have also provided indispensable support and contributions, but national scale competition would not be nearly as vibrant without the significant donations of the primary sponsors. Herschel has noted that Pacer (ZAP) simply wants to give back some value that can contribute to our great sport—and that, they have done. We are honored to team with all the co-sponsors who help produce Top Gun and will continue to deliver the most exciting event highlights to our readers.

—Tom Atwood

In the Pits

David Reid works on his Panther F9F, which he entered in Team with builder Charles Gillispie. The 1/5-scale model is a Ziroli-designed Chuck Gill/Aeroplane Works kit powered by an O.S. 91 with a Ramtec fan; 72-inch span; 19.5 pounds; PPG automotive finish.



ZAP Gang member Dave Platt gets ready to fire up the Moki 1.8 that powers his T-28. The 1/6-scale model has a wingspan of 82 inches and weighs 22 pounds.

Mike Barbee preps his 1/3-scale WACO for flight.

Clark Hopkins' Extra 300 is prepped at the flightline. Clark's 1/3-scale, 96-inch-span model weighs 28 pounds and is powered by a G-62 swinging an Ultra 20x12 prop. It's finished with PPG paint.

Bob Violett (right) and Jerry Caudle work on their Team entry—a Lockheed TV-1. The 72-inch-span model weighs 19 pounds and uses a RAM turbine for power. BVM retracts; PPG finish.

TOP GUN SPONSOR LIST

Primary sponsors
Model Airplane News
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Airtronics
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Major contributing sponsors
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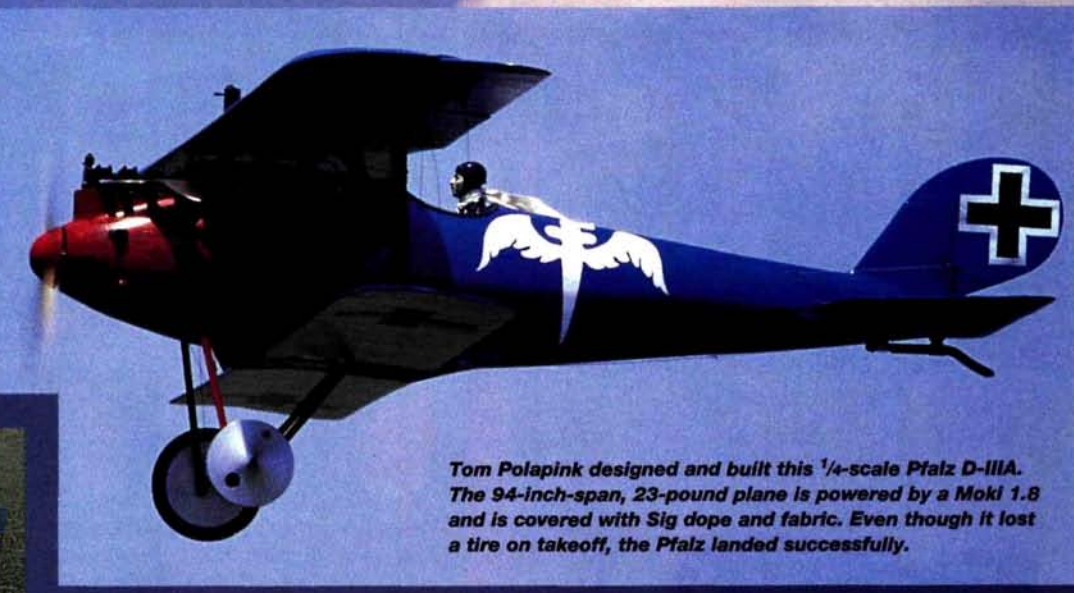
Top Gun announcers
Sam Wright
Dave Platt

HIGH STATIC

Richard Feroldi brought this 1/3-scale 1916 Airco DH-2, which is covered with Sig Coverall with nitrate dope and Rustoleum paint. 113-inch-span; Sachs 4.2 engine; 40 pounds. The model won Best Pre-WW II Aircraft.



Tom Polapink designed and built this 1/4-scale Pfalz D-IIIA. The 94-inch-span, 23-pound plane is powered by a Moki 1.8 and is covered with Sig dope and fabric. Even though it lost a tire on takeoff, the Pfalz landed successfully.

Entered by John Tozser and Bill Fuori, this B-25 captured high Team Static Score. The 1/6-scale model has a wingspan of 121 inches and uses a G-38 turning a Bolly 18x10 prop for power. Robart gear; automotive lacquer finish; 52 pounds.

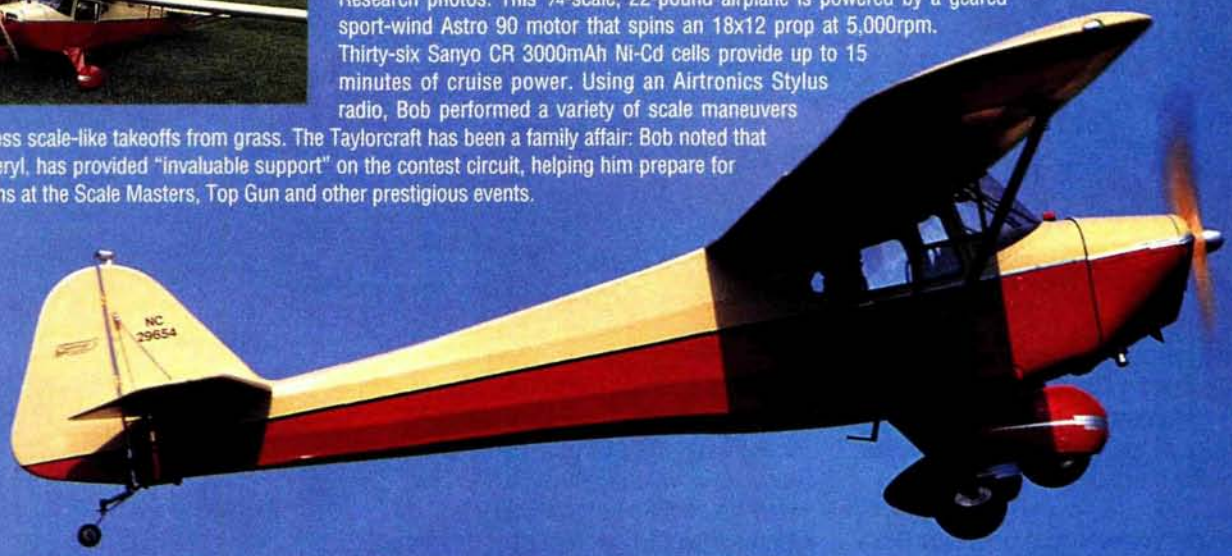
Pat McCurry won the High Static Designer award (and numerous other awards) for craftsmanship with his 1/5-scale Dornier 335. Due to a wind change, officials aborted Pat's first takeoff run. He then made a second attempt as the Top Gun crowd collectively held its breath, but the model nosed in before it was 10 feet off the ground. The 75-pound, 109-inch-span plane had a fiberglass and epoxy finish and was powered by two Moki 1.8 engines.

Kim Foster won High Static in Expert (96.750) with his 1/4-scale Sopwith Pup. Built from Reeves plans, the impressive WW I biplane is powered by a Laser 200 engine.

CATEGORY	WINNER	AIRCRAFT	PRIZE	SPONSOR
High Static Designer	Pat McCurry	Do-335	$200	Aerotech Models
High Static Expert	Kim Foster	Sopwith Pup	$200	R.A. Microjets
High Static Team	Fuori/Tozser	B-25	$200	Jet Model Products
Best Civilian Aircraft	Mike Barbee	WACO	$200	R.A. Microjets
Best Jet Aircraft	Tommy Wood	F-15	$200	Scale Skins Model Co.
Best Military Aircraft	Pat McCurry	Do-335	$200	Don Smith Plans
Best Biplane	Graeme Mears	Tiger Moth	$200	R/C Report
Best Craftsmanship	Pat McCurry	Do-335	$200	Dave Platt Models
Best Pre-WW II Aircraft	Rich Feroldi	DH-2	$200	Glenn Torrance Models
Engineering Excellence	Pat McCurry	Do-335	$200	Jet Model Products
Best Cockpit Interior	Pat McCurry	Do-335	$200	Ray and Robin's Hobby
Highest Static w/Pro-Mark	John Tozser	B-25	$200 Certificate	Pro-Mark
Critics Choice	Pat McCurry	Do-335	$200, 3W-100	Airtronics, Van Dell Jeweler
Best Jet Performance	Terry Nitsch	F-80C	$200	Hobby Nut of Miami
Best 2-Stroke Performance	Mark Frankel	T-34	Moki 2.1 Engine	Moki USA
Best 4-Stroke Performance	Stephan Duerrstein	Ju-52	Saito 150	Saito Engines
Best Gas Performance	Dean Di Giorgio	P-51	3W-60cc Engine	3W and Aircraft Intl.
Best Multi Performance	Gerard Rutten	Beech C-45	$200	The Zap Gang
Highest Total Flight Score	Terry Nitsch	F-80c	$200	Lanier RC
Top Buns Award	Albert Araujo		$100	Top Gun Hussies

FIRST ELECTRIC TO COMPETE AT TOP GUN

Noted electric-scale modeler Bob Benjamin scratch-built this immaculate Taylorcraft based on drawings published in the February '68 *American Aircraft Modeler*. He garnered further scale backup from a reprinted Taylorcraft owner's manual and Bob Banka's Scale Model Research photos. This ¼-scale, 22-pound airplane is powered by a geared sport-wind Astro 90 motor that spins an 18x12 prop at 5,000rpm. Thirty-six Sanyo CR 3000mAh Ni-Cd cells provide up to 15 minutes of cruise power. Using an Airtronics Stylus radio, Bob performed a variety of scale maneuvers and effortless scale-like takeoffs from grass. The Taylorcraft has been a family affair: Bob noted that his wife, Teryl, has provided "invaluable support" on the contest circuit, helping him prepare for competitions at the Scale Masters, Top Gun and other prestigious events.



Continued from page 33

attendance this year was the greatest seen at the Polo Grounds on any Saturday in the facility's history (including the visit by Prince Charles to play polo). The 1,400-car parking lot was filled, and midday Saturday in the four-day event, cars were parked up to a mile away. The crowds were enthusiastic and well mannered—some spectators offered up to $100 for one of the Top Gun shirts specially made for the pilots by ZAP and *Model Airplane News*, but there were no takers.

Sam Wright and Dave Platt did their usual exemplary jobs as announcers, and the West Palm Beach Aeromodelers (host club), static and flight judges, halftime performers, Polo Grounds personnel and all other support persons performed—as usual—to produce one of the most enjoyable modeling events in the world. Don't miss next year's Top Gun, if you can work it into your schedule.

This ¼-scale Curtiss Jr. was entered in Designer by David Fogarty. The model uses a 1.8 Moki for power.

EXCLUSIVE!!

by Steve Pond

Breakthrough

Increase Electric Flight

Electric-powered model aircraft are becoming ever more popular and important and constitute a growing segment within the sport of aeromodeling. New cells distributed by Trinity constitute the latest leap forward for electric flight.

Since the introduction of high-capacity Ni-Cds with relatively low internal resistance, we've seen many technological advances in electric flight, both in airframe materials, motor technology and in the batteries themselves. We started with somewhat temperamental 1200mAh Ni-Cd cells and gradually advanced right up to today's more stable and more powerful 2000mAh cells. Well, just when you might have thought that the final battery-capacity frontier had already been reached, the largest single capacity increase in the history of R/C batteries is about to come your way.

Trinity's new Panasonic 3000 Ni-MH cells

Trinity* has agreed with Panasonic to be the exclusive distributor of Panasonic's new 3000mAh Ni-MH (nickel metal-hydride) cells. They're the first sub-C Ni-MH cells developed specifically for the rigorous demands of R/C vehicles, including aircraft, cars and boats.

Panasonic has been manufacturing rechargeable batteries for quite some time, but Sanyo always seemed to be one step ahead in Ni-Cd technology. At the beginning of 1997, however, Panasonic's parent company, Matsushita, changed its focus and entered a multimillion-dollar alliance with the Toyota Motor Co. to develop Ni-MH batteries for full-size electric vehicles (EVs). Though this had no direct relationship to R/C, the demands made of the batteries used in full-size EVs are very similar to those made of R/C batteries. In some form, the technological leap that led to the development of the batteries used in EVs must have benefited the new batteries from Panasonic.

Ni-MH batteries are not new; in fact, they have been around for a few years, providing power for cellular phones, portable computers and other battery-powered appliances. These applications require far less in the way of current delivery and fast-charge potential. Their batteries require relatively conservative charge rates and have so much internal resistance that a discharge that resulted from a 10-minute conversation on a cell phone would heat the batteries enough to make your ear feel as if it was being cooked! Having trouble handling even mild discharge rates, early Ni-MH cells were hardly capable of withstanding the high charge and discharge rates demanded by R/C applications.

The new technology from Panasonic appears to have the rest of the industry scrambling to catch up. An industry insider even admits to being years behind Panasonic in the development of Ni-MH batteries. So what does this mean to us? Air Age Publishing was given an exclusive opportunity to put a few of these new batteries through the proverbial "lab-test" grinder to see whether the claims for the new cells would be corroborated. Can they really take the abuse (charge and drain regimes) to which we modelers so freely subject batteries?

SPECIFICATIONS

	Sanyo 2000 Ni-Cd	Panasonic 3000 Ni-MH
Length (casing)	1.63 in. (41.6mm)*	1.63 in. (41.6mm)*
Length (overall)	1.67 in. (42.4mm)	1.675 in. (42.5mm)
Diameter	0.87 in. (22mm)*	0.87 in. (22mm)*
Weight	57g	57.1g
Internal resistance (20A/30A)	20/26 RIR**	21.5/28 RIR
Milliwatt hr. (20A/30A)	2347/2228	3372/3286
Avg. voltage (20A/30A)	1.152/1.113	1.143/1.106
Avg. charge time @ 4 amps (sec.)	2760	3982
Avg. discharge time (sec.) (20A/30A)	378/271	546/364
List price (6-cell pack)	$75 to $139	$85 to $119

* Add 0.020 inch (0.5mm) to all dimensions for factory shrink-wrap.

** RIR = Relative Internal Resistance

Batteries

Duration by 50%!

TRUTH IN ADVERTISING

I took the sample cells straight to my fresh-out-of-the-box Turbo Matcher 4—a battery matcher used by many of the R/C car industry's top battery companies, including Trinity.

My first surprise—though I should have expected it—was that it took more than an hour to charge the cells while charging at a 4A rate (incidentally, Trinity advises that we charge the new Ni-MH cells at a rate of 2 to 4 amps). At first, I thought this was an unusually long time, but I quickly realized that a battery that has a 50-percent- higher capacity is bound to take at least 50 percent longer to charge. For the Ni-MH cells, average charge times are in the 3,900- to 4,000-second (65- to 66.6-minute) range at a 4A charge, compared with an average of 2,700 to 2,900 seconds (45 to 48 minutes) for 2000mAh Ni-Cds at the same charge rate.

After this long, "toe-tapping" charging session, the Turbo Matcher 4 eventually reached its re-peak stage and clicked into discharge. The results/times were staggering—an average of 364 seconds discharge time at 30 amps. Thoughts of substantially extended flight times begin to flash through my mind. Since some "floater" electric gliders in the 05 to 15 motor size range pull only 15 to 20 amps at full throttle, this suggested the possibility of 12-minute-plus full-throttle flight times; how many climbs to thermal altitude could you get out of a 12-minute, full-power run time?

Other averages provided by the Turbo Matcher:

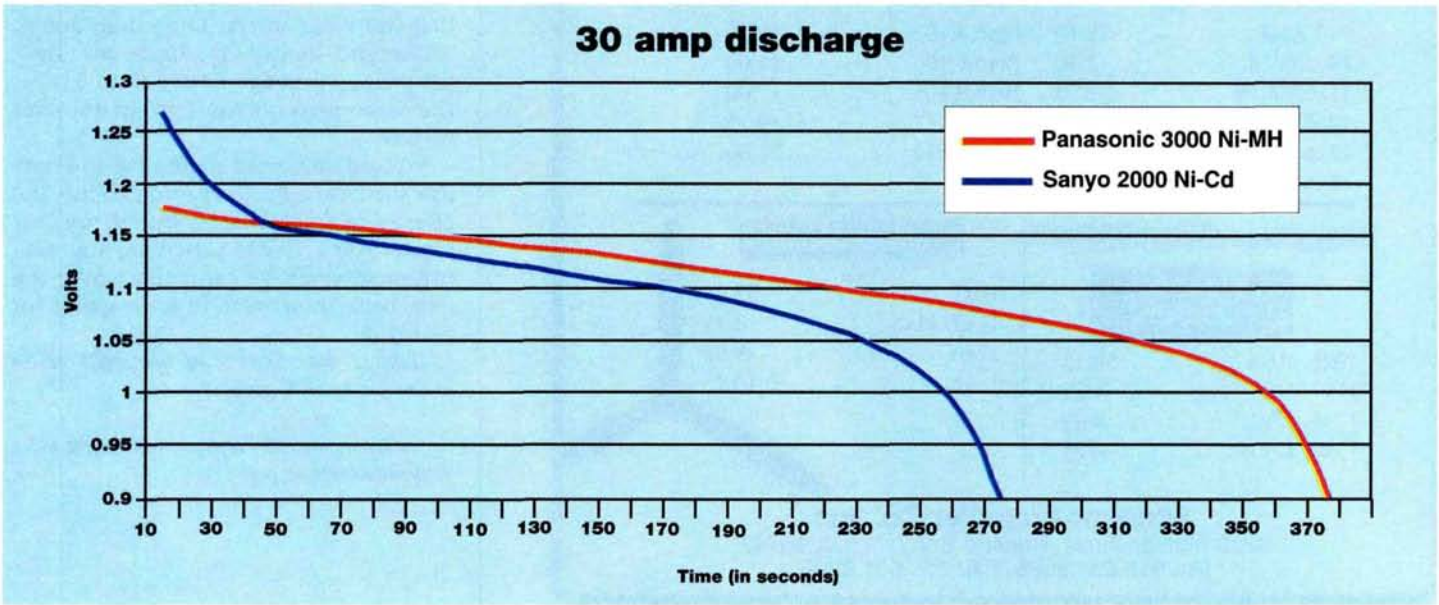
- **average voltage—1.101;**
- **internal resistance—28 (Relative Internal Resistance);**
- **milliwatt hours—3378.**

Compared with those of current 2000mAh matched cells, these numbers are astounding. Current 2000mAh Ni-Cd matched cells produce about 265 seconds of run time at 30 amps with an internal resistance of about 26 milliohms. Their average voltage level is around 1.125 volts, and milliwatt hours average about 2,240.

On the surface, it looks as if the Ni-MH cells have a voltage disadvantage, but when I printed the discharge graph, it showed quite the opposite. The Ni-MH cells' discharge characteristics don't match the high starting voltage of the Ni-Cd cells, but it does show that they can maintain a higher, more consistent voltage throughout the discharge cycle (see graph). The Ni-Cds start with a very high voltage output of approximately 1.3 volts per cell, but after 20 to 30 seconds, this falls to about 1.1 volts per cell, at which point it levels off. The rest of the Ni-Cd cells' cycle shows a more gradual voltage drop until it reaches about 1 volt; then it goes into "drop-off" mode. The Ni-MH cells, on the other hand, start at a more conservative 1.18 to 1.2 volts and maintain a much more consistent voltage level throughout the discharge cycle; in fact, throughout most of the discharge cycle, they maintain a higher voltage level than the Ni-Cds. The Ni-Cds' average voltage appears to be skewed by their higher initial voltage during the first 30 seconds of the cycle. What does this mean? First, you won't have the Ni-Cds' typical initial blast of power that fades after a short time. The Ni-MH cells will deliver power more consistently throughout a run.

DISCHARGING OVER THE LONG HAUL?

How will the Ni-MH cells stand up to high rates of discharge over the long haul? It might be some time before we are able to



BREAKTHROUGH BATTERIES

determine the longevity of these new cells, but during the 10 days I had them (secrecy dictated that I had to ship them straight back to Panasonic), I was invited to test them as I pleased.

I averaged about three cycles a day for 10 days. Some discharges were at 20 amps, but most were at 30. I left the cells alone to cool down to room temperature after discharging them. My tests proved one telling fact: there isn't a noticeable change in performance when you subject the batteries to many cycles in the same day: despite repeated back-to-back cycles—a practice that Ni-Cd cells don't like very much—they maintained voltage, resistance and run time.

Will these cells fit existing battery slots? They match the 2000mAh Ni-Cds in all but one dimension: overall length; they're larger by 0.005 inch—about the thickness of two hairs. So, yes; they will fit any plane that can use 2000 Ni-Cds, and they weigh only 1/10th gram per cell more.

WHAT'S THE BOTTOM LINE?

After my admittedly limited tests of the new Panasonic 3000mAh Ni-MH cells, my conclusion is that they'll open some doors for R/C electrics enthusiasts. They average 100 seconds more run time at a 30A discharge rate than the current 2000mAh Ni-Cds. This will allow longer run times, or the use of hotter motors, or a combination of both. Will these batteries open up new vistas for giant-scale electric airplanes? Or for pylon racing? Whether they can comfortably withstand the rigors of higher amp draws of the scale you might find in the low-drag, brushless-motor-equipped F5B ships is still not known.

Trinity expects to be able to offer a full line of these batteries, ranging from unmatched assembled stick packs right up to VIS Ex-Tra matched Team Spec packs that will range in run times from 365 to 370 seconds at a 30A discharge rate. Their list prices will range from $85 to $119—the same price as the current top-end Ni-Cds!

We certainly need more time to establish the new cells' level of durability and charge characteristics, but if my test results over a 10-day period are any indication of what we can expect over the long haul, then we're in for a whole lot more fun!

[Editors' note: Steve Pond is a senior editor in the Air Age R/C group.]

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

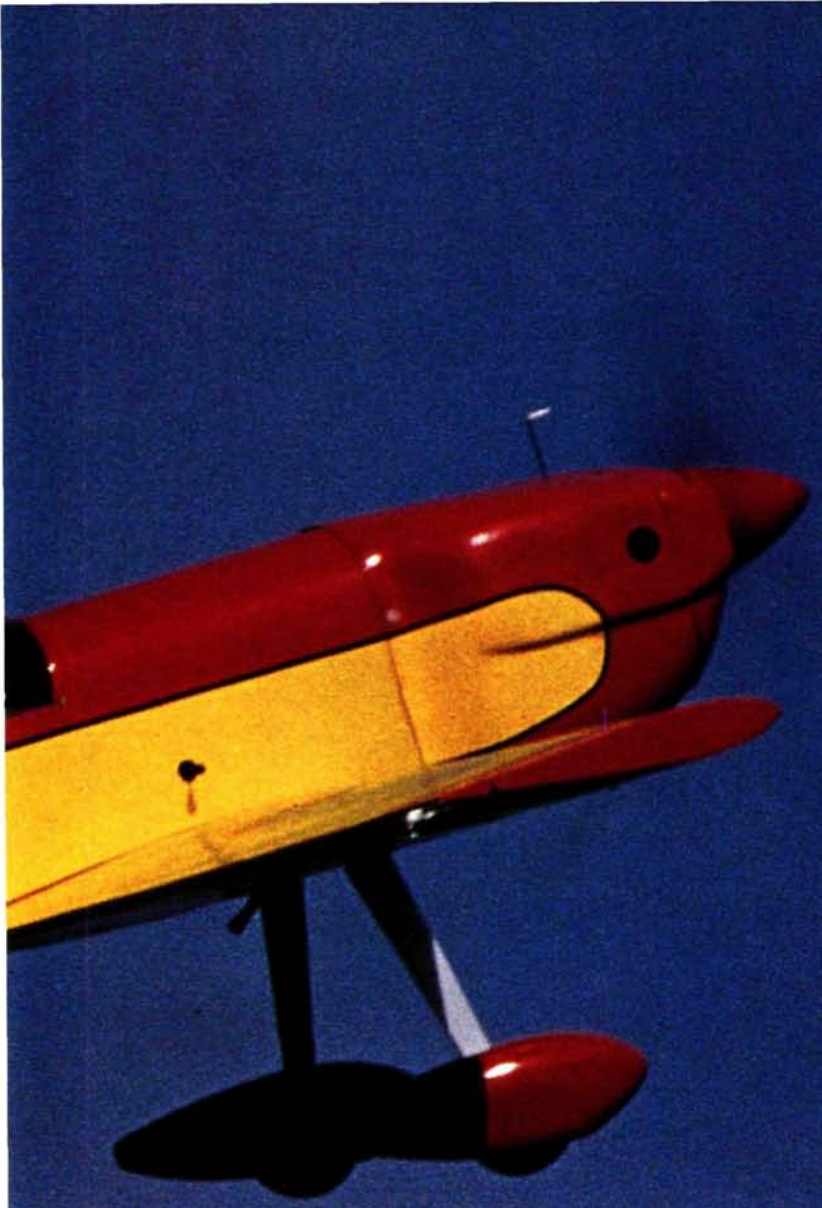
MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

by Lawrence Lay

GREAT PLANES CAP 232

The Great Planes* .40-size CAP 232 is not your typical aerobatic model kit. With a 58-inch wingspan, it's easy to build and transport, requires a relatively inexpensive powerplant and is legal for IMAC and MiniMAC aerobatic competition. It's a good model for intermediate builders and fliers who want to improve their aerobatic skills.

The kit features interlocking, die-cut wood parts, a clear canopy, an adjustable engine mount, hardware, decals, full-size, rolled plans, photo-illustrated instructions, Duraluminum landing gear and a three-piece ABS cowl and wheel pants. The model was designed with dual elevator pushrods for added precision and easier adjustment, and it has a large rudder for better handling and a fully symmetrical wing. The wing also has a lot of dihedral, which isn't true to scale but helps to avoid roll coupling. The model's unique design details include an external, rear-fuselage-mounted rudder servo, a fuel tank inspection cover and a removable fuel tank floor.



SPECIFICATIONS

Manufacturer: Great Planes

Type: semi-scale sport aerobat

Wingspan: 58 in.

Length: 52 in.

Wing area: 594 sq. in.

Weight: 5 lb.

Wing loading: 19 oz./sq. ft.

Airfoil: symmetrical

Radio req'd: 4-channel w/four servos

Radio used: Futaba Super 7

Engine rec'd: .40 to .46 2-stroke, or .52 to .70 4-stroke

Engine used: O.S. .46 FX

List price: $138

Features: die-cut wood parts; symmetrical wing; clear canopy; adjustable engine mount; pushrods, CA hinges, control horns, tailwheel bracket and other hardware; full-size rolled plans; instructions; decals; Duraluminum landing gear; ABS three-piece cowl; ABS wheel pants.

Comments: this is an easy-to-build model that really performs at the field.

Hits

- The CG was right on the money.
- The wheel pants go together beautifully and are indexed to the landing gear so the pants won't move on takeoff.
- Great aerobat.

Misses

- Turtle deck is difficult to form as per the instructions.

Mid-size sport-scale performer

BUILDING THE TAIL GROUP

Cover the plans with wax paper and pin the 1/8-inch-thick balsa pieces to the plans. Make sure that all pieces are squared and in place, then CA them together. Unpin the stabilizer and sheet both sides. Cut off the excess and sand the piece to shape.

Build the elevators out of 1/4x1/2-inch balsa sticks, which must be cut to the correct lengths and angles according to the plans. After you have fitted the pieces together, glue them with thick CA and remove the assembly from the building board. Bevel the LEs of both elevators and add the balance tabs onto the end of each elevator.

The fin and rudder surfaces are built in the same manner as the elevator. Because its rudder is so large, the plane should knife-edge rather well.

WING CONSTRUCTION

Wing construction is probably the most time-consuming part of this kit. You need to study the plans and instructions carefully and fit everything together before gluing. Position the main spar, but don't pin it. The ribs have tabs that go flush on your building table; place the ribs on the spar and start pinning them in place. Take special care when pushing in the T-pins, or you will split the ribs. Place the pins exactly where the instructions indicate or your wing will be permanently affixed to your building board, because you'll sheet the wing before removing it from the board.

After you've built, sheeted and cap-stripped both wing panels, join the wing halves using five wing jigs (two leading edge [LE], two trailing edge [TE] and one center TE jig ensure that the main spar is flush on the building table).You may need to put extra weight on the center of the wing to keep everything in place. When you are satisfied with the fit, apply 30-minute epoxy to the wing dihedral braces and put them into place.

After the epoxy has dried, install the center rib and servo tray, then sheet the center of the wing and rough-sand it. Now install the aileron torque rods and blocks. Shape the ailerons, cut grooves for the torque rods and mark the hinge points and slot them. You've finished with the wing for now.

THE FUSELAGE

The fuselage is basically a plywood box that's built over the plan. It takes approximately one hour to construct it after you've trimmed and fit everything. Take extra care when you put the doublers on F3; these hold the front of the wing in place. Use epoxy rather than CA here.

The wing-mounting blocks consist of two pieces of lite-ply laminated together. I opted to make them out of heavy plywood, to further ensure that the wing

would stay on the plane during flight.

With the basic fuselage still pinned in place, you are ready to fit the wing. Mount the wing as the instructions tell you, with the fuselage still pinned in place on the building board. Make sure everything is square, then drill the dowel pin holes. Now finish up the front of the fuselage. Pay extra attention to the landing-gear mounting block: it sits too low in the cutouts in the fuselage, and you'll end up with a gap between the block and the bottom of the fuselage. I recommend that you don't glue this block in place until you have CA'd the front bottom section of the fuselage. Use 30-minute epoxy to attach the landing gear rail and extra triangle stock inside the fuselage for strength. Unpin the fuselage and attach the firewall with epoxy. The firewall is two pieces of lite-ply laminated with 30-minute epoxy. All the pre-marked holes in the firewall lined up perfectly.

FINISHING UP

Install the stabilizer according to the instructions, and epoxy it into place. Use a square to position the 1/8-inch, die-cut formers and main stringer for the turtle deck. The instructions tell you to CA two pieces of 3/32-inch balsa sheet together, then cut out the turtle-deck halves. It is quite a trick to get this sheet to form the turtle-deck sides, and I recommend using only one sheet of 6x3/32-inch balsa.

Sand the two fin filler blocks to shape and install them. Install the pushrod tubes, and test-fit the removable fuel tank floor. Sand the fuselage, and you are now ready to cover. I decided to dress my model in red, yellow and orange MonoKote* with red and black pinstriping.

If you want it to fit nicely, the three-piece cowl supplied in this kit requires a lot of work. The wheel pants are awesome. The halves are indexed and fit well. The wheel pants themselves are indexed to the landing gear, so they should not move at any time during takeoff or landing.

I decided to use four FMA* servos in the CAP 232. The rudder servo is positioned on the bottom and near the back of the fuselage and hangs down from beneath the fuse. I'd prefer a side-mounted servo because I fly off a grass field and the servo could get hung up easily in taller grass. The elevator pushrods are joined by two wheel collars and then soldered together. This setup works unbelievably well.

For power, I chose a 2-stroke O.S.* .46 FX with a Pitts-style muffler. The cowled muffler keeps everything looking nice.

FINAL THOUGHTS

The Great Planes .40 CAP 232 kit is definitely different. It's easy to build and a great performer. Because of its light wing loading, it floats in for landings like a trainer, but if you flip on the high rates and pour on the power, it will scream for you! If you're looking for an aerobatic plane that can be docile or extremely wild, this is the one for you.

Addresses are listed alphabetically in the index of Manufacturers on page 150.

FLIGHT PERFORMANCE

After the first flight, I installed two washers behind the engine mount for some downthrust. Then I changed the rates; I made the high settings low and cut the low settings in half. I also put a lot of exponential on the rudder and elevator.

• TAKEOFF AND LANDING

This plane wants to fly. On the initial flight, it was off the ground at 3/4 throttle in about eight to 10 feet, with no rudder or snap on takeoff. It gained speed and altitude quite quickly.

Landing the CAP 232 is a breeze. Fly it in with three clicks of throttle, chop the elevator 50 feet off the end of the runway and pull back on the elevator; the model settles in like a trainer.

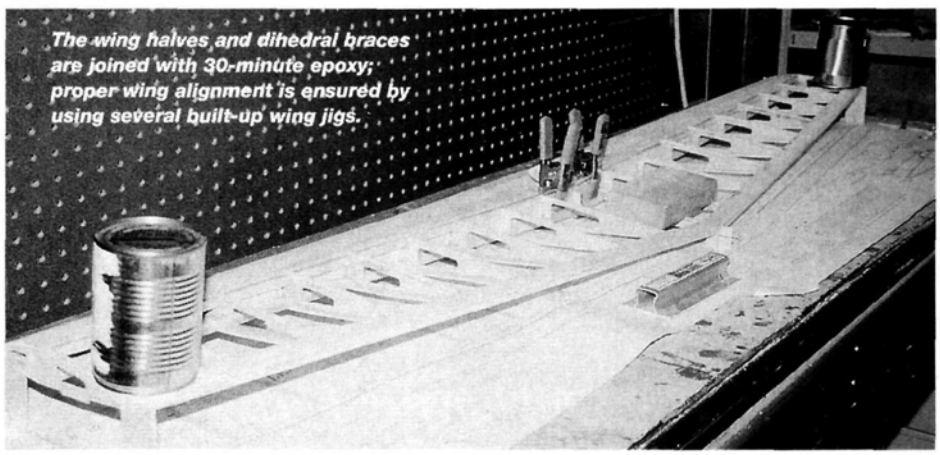
• LOW-SPEED FLIGHT

I added down-elevator and pulled the throttle to 1/4, then to idle. I added in a few clicks of throttle, and the CAP flew unbelievably slowly, with no stalling tendencies.

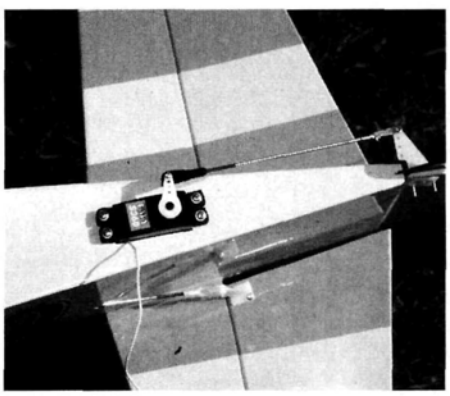
Dead-stick is unbelievable; the plane wants to keep on flying. It didn't drop out of the sky; it came in slow and easy without any bad characteristics.

• AEROBATICS

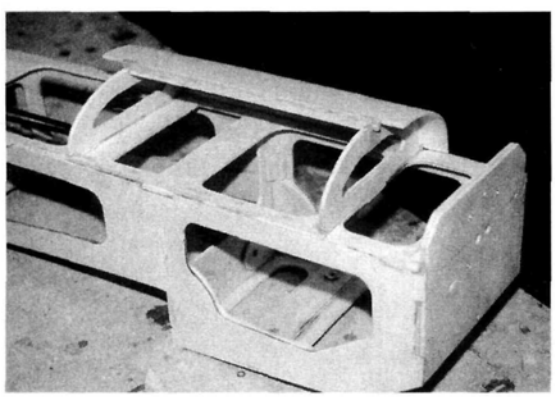
Flip the rudder on high rate, pull up-elevator and roll into a knife-edge; you can stay there all day long. Rolls and loops are as tight as you would like. Inverted flight is almost effortless with a little down-elevator once in a while.



The wing halves and dihedral braces are joined with 30-minute epoxy; proper wing alignment is ensured by using several built-up wing jigs.



The rudder servo is mounted in the tail, exiting the bottom of the fuselage; this provides proper balance and an unobstructed hookup.



Fuselage assembly takes only about an hour once everything is trimmed. The top sheeting fits in place forward of the cockpit.

BIG Brother

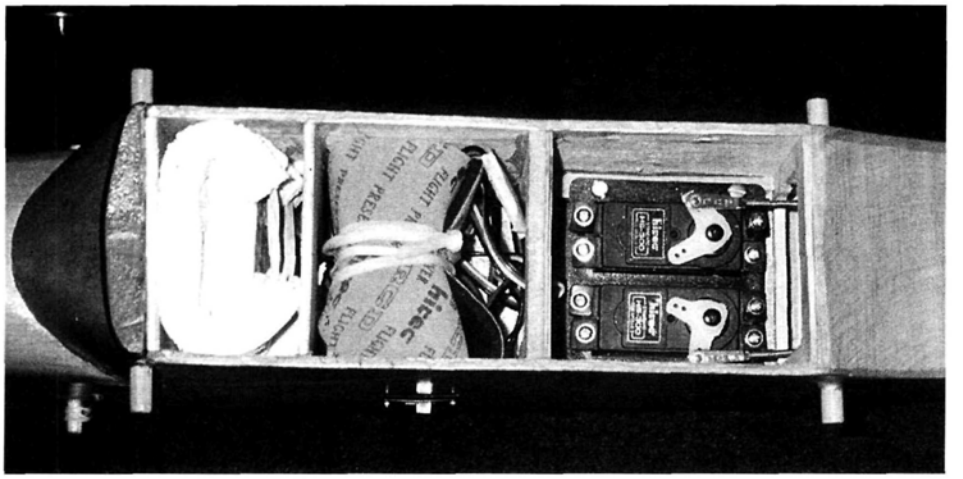
A 2-channel, lightly loaded trainer

by Art Christensen

WHEN I WAS AN ACTIVE free-flight competitor, I flew an original Pan Am design that always finished in first place. After I had learned to fly R/C sailplanes, I built an inexpensive, 2-channel, powered trainer using some of the design parameters from the Pan Am design. The airplane features rudder and elevator control and has a modified nose moment to keep the center of gravity (CG) in a forward position (30 to 40 percent of the chord). By carefully choosing the wood, I kept the model's total weight to only 26 ounces. This gives a wing loading of 9.6 ounces per square foot—only slightly higher than the 8-ounce wing loading required by AMA free-flight rules. This allows for easy hand launches and eliminates the hazards of takeoffs. The large fields required to fly R/C sailplanes have all but disappeared in the Chicago area, where I live, so the Big Brother was designed with smaller flying fields in mind. Construction is relatively easy; let's get started.

FUSELAGE CONSTRUCTION

The plans are quite accurate, and templates can be made directly from the drawings. Begin by cutting the forward, side and bottom sections out of 1/8-inch lite-ply as shown on the plans. Cut the rear of the fuselage (both sides, top and bottom) out of 1/8-inch medium balsa. Form the two sides by gluing the rear side pieces and the lite-ply forward sections together at the long diagonal splice. Cut former F-1 from 1/8-inch A/C plywood and cut formers F-2 through F-9 from 1/8-inch lite-ply (note the grain direction). Mark the centerlines on the formers with a pencil and start the assembly of the fuselage by adding the 1/4-inch-square balsa to the rear as shown on the plans. Lay the fuselage upright on the top view, making sure that the formers are in line with the plan centerline. Begin with former F-3, then former F-6. This will produce a slight bow in the sides between F-3 and F-6. To eliminate this, install formers F-4 and F-5; be sure that the pencil marks on the formers align with the plan centerline. Now install formers F-7, F-8, the rear 1/8-inch lite-ply doublers and former F-9. Attach the 1/16-inch plywood doublers to the tops of for-



The Big Brother's design allows ample room for servos, receiver, batteries and any required ballast.

SPECIFICATIONS

Model name: Big Brother

Model type: Sport flier/trainer

Wingspan: 55 in.

Length: 33 in.

Chord: 7 in.

Wing area: 385 sq. in.

Wing loading: 9.6 oz.

Engine recommended: .049 or .051

Engine used: Cox .049

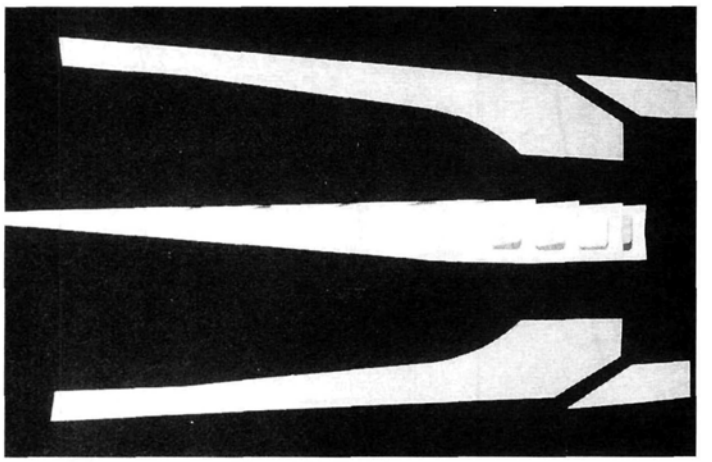
Radio req'd: 2- or 3-channel (rudder and elevator)

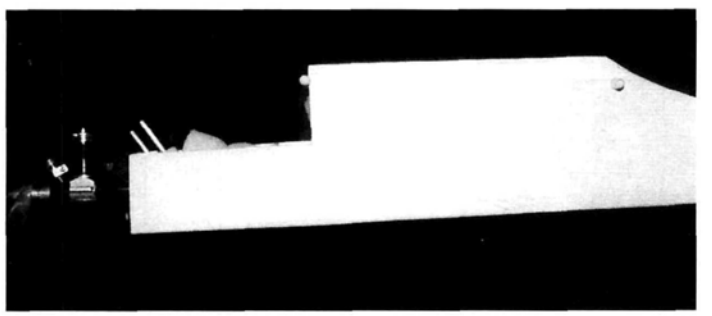
Radio used: Hitec Focus 4

Comments: made out of balsa, lite-ply and spruce, Big Brother is a sport trainer that can perform like a powered model but will also thermal like a sailplane. Use some up-elevator when making turns, and be sure to have enough speed on approach and landing.

mers F-4 and F-5, then epoxy the 0.093-inch-diameter brass tube to the rear of F-2. Use the landing wire as a guide to find the position of the landing-gear mount dowel; drill the hole and glue the 3/16-inch mount dowel into place.

Before gluing former F-1 to the fuselage, decide on the type of engine mount you want to use and attach it to F-1. Install the engine and drill any necessary holes in F-1, then remove the mount and epoxy the former into place flush with the forward edge of the fuselage. I used a conventional Cox* tank mount, but for longer flights, a 1-ounce Sullivan* tank will fit nicely between formers F-1 and F-2. Now glue the 1/8-inch lite-ply bottom piece and the 1/8-inch bottom balsa sheeting to the fuselage. For added strength, you can install 45-degree gussets to the bottom of the formers as shown on the plans before you attach the top 1/16-inch balsa sheeting. To complete the fuselage, install the 1/4-inch wing hold-down dowels, then attach and carve to shape the windshield and front cowl blocks. If you plan to install a separate fuel tank, do not permanently glue the blocks into position until after the tank is in place.

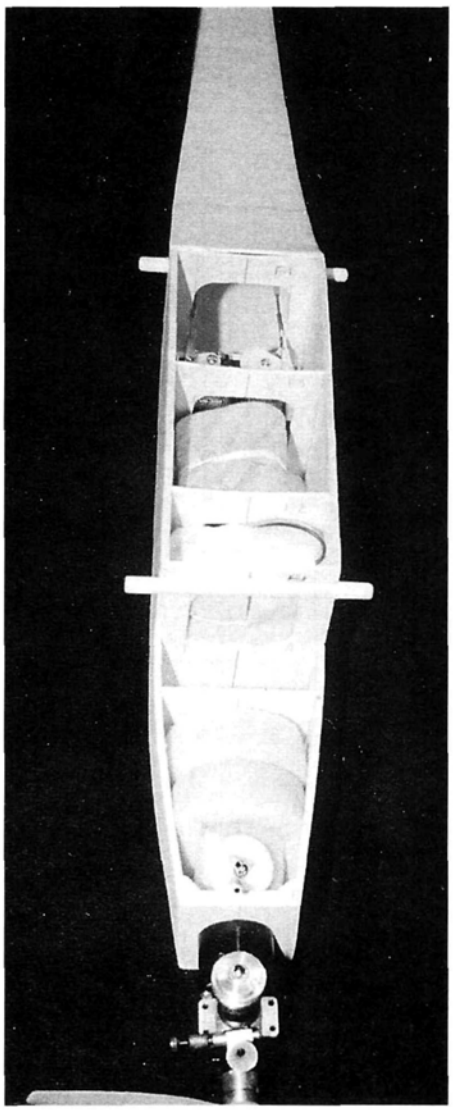




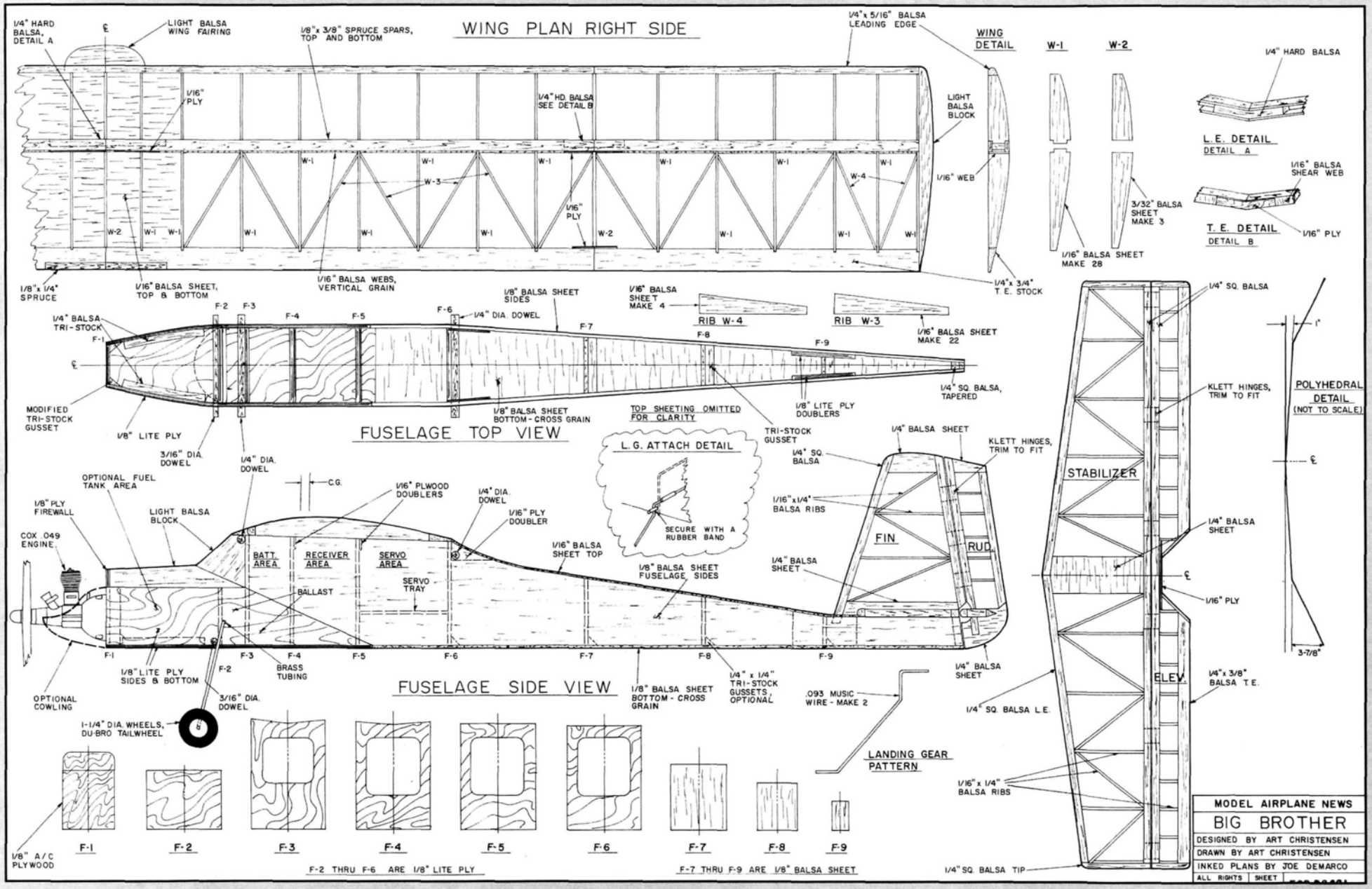
Top: start construction by cutting 1/8-inch lite-ply for the front, bottom and sides of the fuselage. Bottom: lite-ply laminated to 1/8-inch medium-grade balsa forms the outer structure. You should trial-fit your engine mount to it before you attach the firewall to the fuselage.

WING CONSTRUCTION

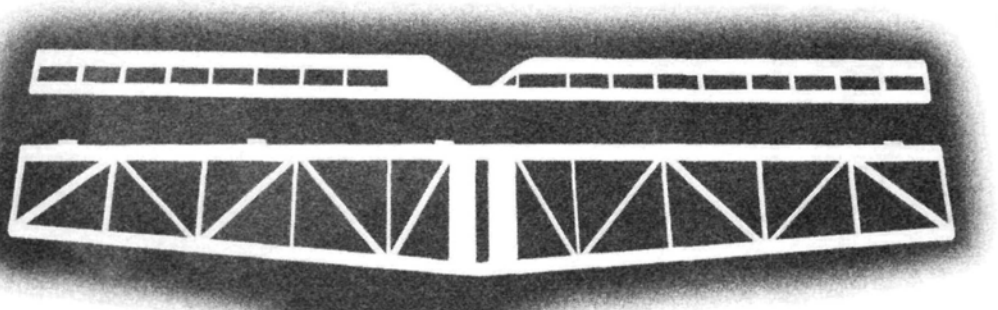
Many years ago, Carl Goldberg asked me how I managed to build such perfectly flat surfaces! Coming from Carl, this was a compliment, and the answer was easy: be choosy in wood selection. Choose straight wood for the spars, leading edge (LE) and trailing edge (TE). Before assembly, cut all spars, LE and TE to the required length. Position the 1/8x3/8-inch bottom spruce spar and balsa LE and TE on the plans (notch the TE). Glue all W-1 ribs to the bottom spar, LE and TE except at the polyhedral joints. Glue the top spruce spar into position on top of W-



The 1/16-inch top sheeting and the radio gear are now in place. A 1-ounce Sullivan tank fits nicely between the front formers.

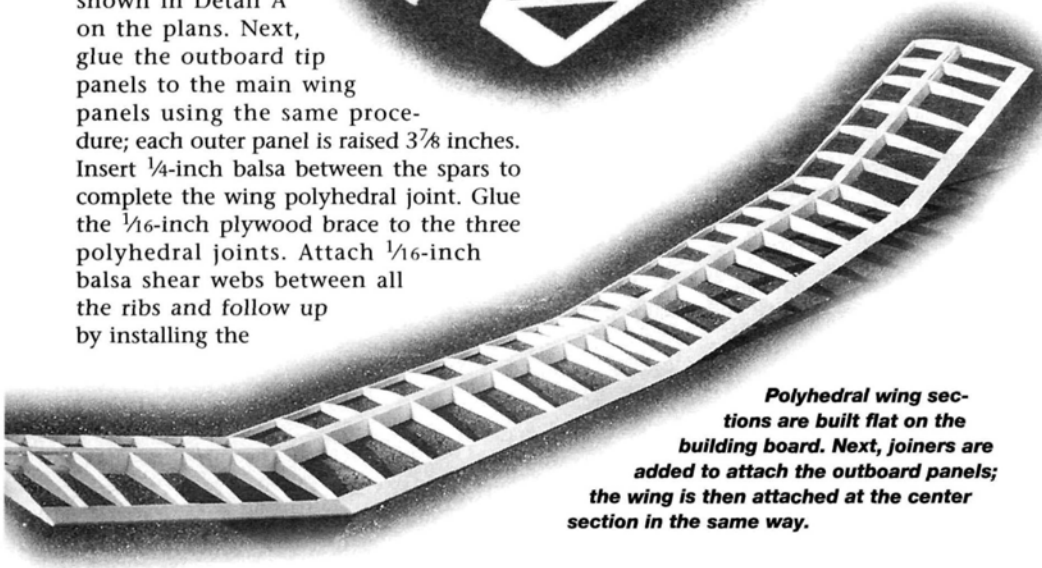


FSP08991 TO ORDER THE FULL-SIZE PLAN, SEE PAGE 144 OR CALL (800) 537-5874.



It's important to select the wood for the tail feathers carefully: strong, warp-free balsa ensures a light, sturdy structure.

1 ribs. After the glue has dried, raise each inboard panel 1 inch. Glue the upper and lower spars together to form the inboard panels, then insert the ¼-inch polyhedral joiners as shown in Detail A on the plans. Next, glue the outboard tip panels to the main wing panels using the same procedure; each outer panel is raised 3⅞ inches. Insert ¼-inch balsa between the spars to complete the wing polyhedral joint. Glue the 1/16-inch plywood brace to the three polyhedral joints. Attach 1/16-inch balsa shear webs between all the ribs and follow up by installing the geodetic ribs, as per the plans. Use ⅛x¼-inch spruce laminate on the TE to shield it from the rubber wing hold-downs. Be sure to sand the LE and TE to the shapes shown. The solid tips should be of light balsa stock. Complete the wing by sheeting the center section upper and lower surfaces.

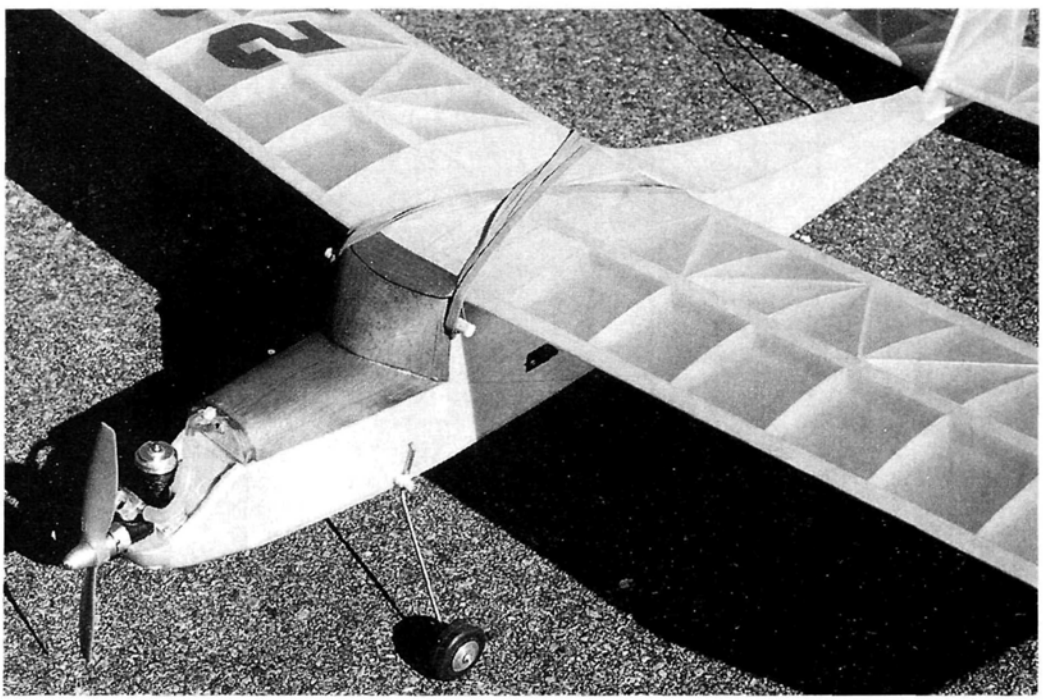


Polyhedral wing sections are built flat on the building board. Next, joiners are added to attach the outboard panels; the wing is then attached at the center section in the same way.

FINISHING UP

Carefully select the wood for the stabilizer, rudder and fin, being sure the LE, TE and hinge stock is free of warps. Sand it to shape.

The building phase is complete. There is plenty of room in the fuselage for all the radio equipment. I used a Hitec* Focus 4 with HS-300 servos. Now is the time to check for CG position; if everything is in order, the model should balance as shown on the plans.



used silk to cover Big Brother. This was probably a mistake because shrink films such as Ultracote* resist fuel spills much better. The model's construction is solid; it doesn't need the strength of silk to hold it together!

AT THE FIELD

Big Brother can be hand-launched, or it can take off from a runway. If you take off from a runway, however, be aware of a strong pull to the left because of high torque and low initial airspeed. Because of its polyhedral wing and light wing loading, Big Brother's flight characteristics are somewhat like those of an R/C sailplane. Weighing in at only 26 ounces, the airplane will gain more than enough altitude to soar with thermals! Without throttle control, landing will be dead-stick—also similar to an R/C sailplane. Try to have ample altitude after the engine stops; plan your approach pattern accordingly. Because I don't have a paved runway and the flying field grass is high, I removed Big Brother's landing gear and fixed the prop to stop in a horizontal position. No problem! Landings are smooth and uneventful.

I believe this manner of flying will encourage the newcomers who build large, powerful trainers but lack the flying experience needed to handle ailerons, throttle, rudder, elevator and steerable tailwheels. We lose too many beginners after disastrous and expensive first flights!

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

Airtronics RD6000 Computer Radio

by ROGER POST JR.

PROGRAMMING MADE

Sanwa's Airtronics* division has just introduced the RD6000—a 6-channel, 4-model-memory (airplane, glider and helicopter) computer radio. Its ease of use seems to be targeted at beginner pilots who might be overwhelmed by other high-tech programmable radios, but expert fliers will enjoy it as well.

The big news is how easy it is to program: you can scroll through channels, e.g., aileron, elevator, throttle, etc., across the top of its large LCD screen, and then down through the functions, e.g., dual rate, servo-reversing etc., within any selected channel (see the "Aircraft Basic Menu Structure" table), and that makes this a readily understandable, good first programmable radio.

The RD6000's transmitter weighs only 26 ounces and has an extremely well-balanced feel when it's held for flying with the antenna extended.

SPECIFICATIONS

Model: Airtronics RD6000

Type: 6-channel, 4-model computer radio that's available on all 72MHz frequencies; also available with FM, PPM and PCM modulation.

Manufacturer: Airtronics

Transmitter: weight—1 lb., 10 oz.; 6-channel, dual stick with propriety microprocessor; 4-model memory; for three types of models (airplane, glider, helicopter; airplane and glider coexist on the airplane model).

Receiver: weight—1.2 oz.; 92777 PPM/FM 7-channel, super narrowband with universal Z-connectors. To use other Airtronics receivers, you need to use 99399 "Z" adapters.

Servos: four 94102 non-ball-bearing servos with Z-connectors.

Accessories: switch harness; 4-cell, 4.8V, Sanyo 600mAh battery pack; accessory pack; channel numbers and antenna flag; aileron extension; 120V AC wall charger; manual.

Weight of complete airborne unit: 11.2 oz. (including servos, receiver, battery, etc.).

Part no: 90310

Street price: $265 (estimate)

Features: six channels; four models; throttle-high alarm that beeps when the system is turned on; dual-rate alarm; throttle-cut function; servos have the new Z-connectors and a polarity change in the wires that allows them to be compatible with other brands of radio; receiver has the same polarity-change feature (it allows other brands of servos to be used with it); dual-rate and mix/switch reversing; two levels of programming (basic and advanced); good manual.

Comments: the RD6000 is an excellent system for beginners looking for a first computer radio. Its ease of programming will make all levels of modelers quite happy. It has some great safety features that will help to prevent engine start-up mistakes and help prevent pilot inattention to details.

Hits
- Easy to program.
- Throttle-high alarm.
- Throttle-cut button.
- Dual-rate and mix/switch reversing.
- Servos and receiver are compatible with other brands of radio.
- Dual/rate alarm.

Misses
- Only one switch to activate three programmable mixes.
- No potentiometer knobs for specific settings.
- Insufficient switches to turn off each program function individually (if you are accustomed to higher-end, more expensive radios).

PROGRAMMING MENUS

There are two programming menus:
- **Basic**—offers functions such as servo centering, reversing, endpoint adjustment, etc.
- **Advanced**—contains all the functions of the basic program plus many more—V-tail, elevon, spoilerons, etc.

When a newcomer is ready to go beyond the basic functions, the transition to using the advanced-menu functions is easy.

EASIER

The RD6000 can be used for airplanes, gliders and helicopters (airplane and glider features are on the same program). The factory setup is for two airplane/glider and two heli models, but you can change this to four airplane/glider models or four heli models, or any combination of the two types.

The radio also offers some innovative, new safety features that are explained below.

TRANSMITTER

Like any other enthusiastic modeler, when I opened the box, I first pulled out the transmitter (TX). It's light and very comfortable to hold. When I turned the radio on, I immediately heard a beeping sound that continued until I turned the radio off. Thinking the battery was low, I charged it for 24 hours and then tried again—with the same result. Hmm .... time to read the manual.

Aha! There it is, stated clearly on the bottom of page nine: if you turn on the TX, hear beeping and see TH Hi on the liquid-crystal display (LCD), your throttle stick is not in the lowest position. This is a great safety feature because, providing you can hear the beep, it warns you that you're about to start your engine at a throttle setting that is not the lowest—throttle trim excluded. And absolutely nothing will function (you can't program anything, and control-stick movements don't move control surfaces) until you move the stick to its lowest position. When used correctly, this feature will save many modelers from being chewed up by the propeller of a runaway plane that has unknowingly, or unexpectedly, started at a throttle setting that was higher than anticipated. It pays to read the instructions first!

KEY TO ABBR. IN CHART BELOW	
EL	elevator
AI	aileron
TH	throttle
RU	rudder
G	gear
P/F	flap
etc	miscellaneous
STW	stopwatch
REV	servo-reversing
D/R	dual rate
CNT	servo centering
EPA	endpoint adjustment
MSL	model select
TYP	model type
RST	reset
BASIC (ON)	basic to advanced menu toggle

Aircraft Basic Menu Structure

EL	AI	TH	RU	G	P/F	etc
STW	STW	STW	STW	STW	STW	MSL
REV	REV	REV	REV	REV	REV	TYP
D/R	D/R	CNT	CNT	EPA	CNT	RST
CNT	CNT	EPA	EPA	-	EPA	BASIC (ON)
EPA	EPA					

Note: use the ◀CH- and CH+▶ keys to move horizontally within the same function.
Use the ▲FUNCTION and ▼FUNCTION keys to move vertically within the menu.

PHOTOS BY WALTER SIDAS

Note the simplicity of the menu structure. For example, under the elevator channel (EL), you can scroll down to servo-reversing (REV) and then back up, or across to REV under other channels.

The TX has six channels:

• **Channels 1 through 4** are controlled by two, standard, adjustable, gimbaled sticks, and each also has a digital trim button in the standard place.

• **Channels 5 (landing gear) and 6 (flaps)** are controlled by two, two-position toggle switches for channels 5 and 6.

Each digital trim has a corresponding display bar in the LCD that tells you where the trim is in relation to the center position. Each incremental adjustment in trim results in a beep, and a quick, double beep sounds when you hit the center position.

There are two dual-rate switches for aileron and elevator. In the heli mode, there's an additional dual-rate function on the tail rotor (aka rudder channel). A mix switch (C-MIX 1,2/AI-RU MIX) on the transmitter) can turn on three mixes at once. These five switches have a neat feature in that their on/off positions can be reversed in the advanced programming sequence. They are, however, all ganged together; they can not be reversed individually.

An alarm on the dual-rate switches beeps every 15 seconds (it can be turned off) to tell you the dual rates are activated—a handy warning signal to any pilot who has forgotten which rate he is using. The letters associated with the five switches are color-coded: red for airplane functions and white for heli functions.

To the outside of the dual-rate switches are two small buttons: on the left is the trainer button (the RD6000 is trainer-compatible with another 6000—a Vanguard or a Radiant) and on the right is a throttle-cut button—another great feature because it allows you to turn off the engine without getting your precious fingers in the way of the propeller (more on this later).

The easy-to-read LCDs displays:

- battery voltage.
- channel selected.
- function selected or model name.
- battery "fuel gauge" bar (shows how much battery power you have left).
- digital-trim position.
- model number selected.
- modulation selected.
- tiny arrows that match the cursor arrows on the panel input keys.

To the immediate right and left of the LCD are two digital trims for the heli mode. The right one raises or lowers the hover throttle setting, and the left one regulates the hover pitch setting.

On the lower face of the TX are the input keys:

• **channel keys** allow you to go back and forth between the channels—horizontal movement.

• **function keys** allow you to move vertically within a channel.

• **"YES" and "NO" buttons** change the amount (plus or minus) of the function input.

• **End button** gets you back to certain places, depending on how many times you press it. The manual gives fairly clear instructions on its use.

• **Flight-mode button** is used only for the heli mode, and it switches the programming between Normal, Flight Mode 1 and Flight Mode 2.

The transmitter's LCD displays battery voltage, channel selected, function selected or model name, battery "fuel gauge" bar, digital-trim position, model number selected, modulation selected and tiny arrows that match the cursor arrows on the panel input keys.

BATTERY POWER

The TX is powered by a 9.6V, 600mAh, 8-cell, Sanyo battery pack that—because of an internal diode—requires you to remove it if you want to cycle it. According to the LCD, a full charge from the 120V AC wall charging unit gave the pack 11.6V; a continuous alarm sounds when the battery has run down to 9.5 volts. The TX will, however, function for at least another half an hour after that, and that gives you plenty of time to land. (An experiment in the workshop verified this.)

When the TX has been turned on for 15 minutes without any stick movement, it starts beeping. The memory is stored on EPROM chips, so there is no need for a lithium battery.

If you use a PCM receiver, there is a battery fail-safe (BFS) that, when activated, will cycle the throttle channel to a

The panel input keys are on the bottom of the RD6000's TX. The channel keys allow you to go back and forth between channels—horizontal movement; the function keys let you move vertically within a channel. The input-key arrows correspond with the cursor arrows on the LCD.

er, function for at least another half an hour after that, and that gives you plenty of time to land. (An experiment in the workshop verified this.)

When the TX has been turned on for 15 minutes without any stick movement, it starts beeping. The memory is stored on EPROM chips, so there is no need for a lithium battery.

If you use a PCM receiver, there is a battery fail-safe (BFS) that, when activated, will cycle the throttle channel to a low setting and then back to a normal setting (once every minute) when the receiver battery voltage reaches 4.7. When you hear this, you have a few minutes to land.

The narrowness of the RD6000's receiver makes it ideal for sailplanes with slender fuselages.

Two things I like about the airborne unit are the Z-connectors and the fact that these Airtronics servos and receiver have the same polarity as those of other manufacturers.

AIRBORNE UNIT

The RD6000 airborne unit reviewed here consisted of:

- a 92777 PPM/FM 7-channel, super narrow-band receiver with universal Z-connectors.
- four 94102 non-ball-bearing servos (FM) with universal Z-connectors.
- a Sanyo 4-cell, 4.8V, 600mAh battery pack.
- a switch harness and an aileron extension.

The servos are of standard size, and the total airborne weight is 11.2 ounces. For a higher price, PCM/FM receivers, ball-bearing servos and higher-capacity battery packs are available.

The receiver is narrower than the Airtronics receivers I've seen in the past, so it's more convenient to install in a small, narrow fuselage—such as an electric glider's. It also has a thicker antenna wire, which is a welcome change from some of the flimsy antenna wires I've seen.

Two things I like about the airborne unit are the Z-connectors and the fact that these Airtronics servos and receiver have the same polarity as those of other manufacturers. This allows you to plug the RD6000 receiver into a radio setup of a different brand and check out the capabilities of your new radio. And for all who have had to switch the servo-plug ends and polarity of their older Airtronics servos to make them match those other brands will know what a welcome relief this is! The servo's Z-connectors have quite a strong grip on the three prongs in the receiver, so take care when you remove a servo connector.

The yellow tags on the servo wires warn you not to use these servos with older Airtronics receivers because of the danger of reversing polarity.

MANUAL

The instruction booklet has two sections: one for airplane/glider and one for heli. The manual features that make this radio so easy to use are the panel input keys and the LCD illustrations that accompany each step of programming. In each drawing, the input key that is supposed to be pressed is shaded, and the LCD has what should appear on the screen as you program.

In general, I found the manual self-explanatory, with easy-to-read and easy-to-follow instructions. I recommend that you highlight the many notes and "caution" sentences in the manual so they will attract your attention. I could not find an explanation of the elevator-to-flap coupling (adding elevator trim to the flap deployment), but this wasn't a big deal, since the programming of this feature is self-explanatory.

PROGRAMMING

After you've turned on the TX (don't forget to have the throttle stick in its lowest position), press the right channel button on the panel input keys once to start to program. From there, you will notice three arrows that are grouped in the LCD just to the left of the three-letter STW (or stopwatch) readout. These arrows indicate which way you can go to continue programming. The arrow that points down coincides with the function arrow that points down on the panel input keys. The right and left arrows coincide with the right and left channel keys on the panel input keys. If an arrow is missing from one or more of the four directions, "Ya cain't git thar from heere."

Whereas TXs of other brands have you scroll through the channels while in a particular function, the RD6000 does just the opposite. Within each channel, you can scroll vertically (in both directions, except when at the top or bottom of the list) to display a desired function. For example: if you scroll across to the rudder channel in the Basic menu and then use the function down key, you will see STW, REV (servo-reverse), CNT (acts as a subtrim to center a control surface) and EPA (endpoint adjustment).

If you scroll back up with the function up key to STW and then through the channels to the right, you come to an LCD readout labeled "etc" (A quick note: the RD6000 allows you to scroll back and forth horizontally through the channels and some of the functions; you no longer need to cycle through the entire channel menu to get back to where you want to be. This also applies to the vertical scrolling of the functions—a definite plus.)

Now scroll down through the "etc" column to see MSL (model select), TYP (type of model—airplane or heli), RST (resets factory programs only for the selected model number) until you reach Basic (on). Press the YES button to turn off the Basic

Basic menu—R>A (slaves aileron to the rudder stick), R>E (slaves elevator to the rudder stick) and FAIL (fail-safe—allows the rudder to be programmed to a certain position to cope with RF interference. This is only for PCM receivers).

Now scroll back to the "etc" column; the long list of advanced features contains all of the high-tech functions you would expect to find in a more expensive radio: flaperons, spoilerons, crow mixing, V-tail mixing, delta-wing mixing, two separate mix capabilities (C-MIX 1 and 2), aileron differential, landing differential, etc. If you're looking for couplings such as flap-to-elevator, rudder-to-aileron, elevator-to-throttle, aileron-to-rudder, elevator-to-rudder and elevator-to-flap, there are two ways to do this: go to the individual channels and scroll to those features, or set up two of them in the two C-MIX functions.

If you program two of these couplings into the two MAS/SLV C-MIX functions under the "etc" column, both will be on or off, depending on the C-MIX 1,2/AI-RU MIX switch position. If you program the mixes available under the individual channels, you will only be able to turn off two of the coupled mixes: the elevator-to-flap coupling and the rudder-to-aileron coupling. You do this by flipping the flap toggle switch or the C-MIX 1,2/AI-RU MIX switch, respectively.

All other programmed couplings will be there whenever you move a stick. Note, however, that the elevator-to-throttle coupling that's under the throttle channel helps to trim the plane every time you add or reduce power, so it doesn't have to be turned on or off because it is to your advantage to have it available whenever you move the throttle stick.

For a beginner, the lack of switches helps to reduce the confusion about which switch corresponds to a particular programmed mix. But if you are used to having all the bells and whistles dialed in to your plane and to being able to turn them on and off individually, you'll have to plan how you want your plane set up because of the limitations on which of the mixes you can turn off.

If you couple the flaps to the elevator (E>F under the elevator channel) and find that the flaps move in the same direction as the elevator when the elevator stick is moved, press the YES and NO buttons simultaneously to defeat the coupling and reprogram the amount you had dialed in, but with the opposite polarity. When used for an airplane, the flaps—channel 6—are either up or down; there is no way to lower the flaps in increments. If they are used for a glider, the throttle stick (the flap servo is plugged into the throttle channel) will lower the flaps in varying degrees.

The landing-gear channel has EPA. You can now program how much the gear servo goes up and down and that eliminates the need to do it mechanically via servo arms, linkages, etc. If you have retracts, access the landing-gear channel so it is displayed in the LCD, then scroll down until EPA is shown on the readout. Now, flick the gear switch—top of the TX, left-hand side—and retract the gear. If they don't close all the way or if they go so far that you hear the gear servo-motor buzzing, press YES or NO to achieve the results you want. This function makes setting up retractable landing gear quite easy and will save you from many frustrating hours of adjustments.

Overall, programming the RD6000 is extremely easy, and it is set up very logically. Like all computer radios, the more you "fiddle" with it, the more you'll understand how to use it.

Under the throttle channel, you'll find the throttle-cut program. This is a terrific feature because it allows you to stop the engine without going near the propeller. To set throttle-cut, simply lower the throttle stick, then scroll down the throttle channel until you come to T-CUT (throttle cut).

Now, press the NO button until you reach the percentage you think would close the carburetor barrel completely. Press the T-CUT button and look into the carburetor venturi to see how close you are. Press the YES or NO button to correct the setting. When the correct amount has been set, you can stop the engine via the T-CUT button.

Overall, programming the RD6000 is extremely easy, and it is set up very logically. Like all computer radios, the more you "fiddle" with it, the more you'll understand how to use it. And if you later lose the RD6000 manual, there's no need to sweat it because after you've read it and programmed your TX a number of times, you won't need it.

HELI MODE

I'm not well-versed in helicopters, so I showed the RD6000 to contributing editor Dave Baron, who says it has quite a complete heli menu structure with excellent trim capabilities. He mentioned these pluses:

- The concept of revolution mixing is completely isolated for each of the three flight modes—normal, idle-up and throttle hold.
- The throttle curves for the three flight modes each have five points and can be adjusted to suit your needs.
- Ditto for pitch curves.
- The revolution has a three-point set range that includes a middle setpoint.

AT THE FIELD

I tested the radio in a profile, fun-fly-type aircraft with many mixes dialed in. The range check—with the antenna collapsed and engine running—showed a range of well over 100 feet. Without the slightest problem, the receiver withstood the vibration of the profile airframe.

In the air, the RD6000 operated smoothly, and all stick inputs produced instant results. I tested the range again by taking the model up as high as I could while still being able to see what it was doing. Everything functioned perfectly.

At that high altitude, I did try something that I don't recommend to beginners or novices. I had two different sets of functions programmed consecutively into the TX on models 1 and 2. I took off on model 1 and switched to model 2 in mid-flight. Yes, this can be accomplished without turning off the TX. Doing this enabled me to try out a couple of the different mixes that otherwise would have functioned all of the time if I had programmed them into one model setup. If you're an advanced pilot and plan to try this, make sure you test this procedure at home and know it thoroughly before you go out to fly; plenty of altitude helps as well.

WRAP-UP

The RD6000 is a snap to program, and in it, you'll find all the mixes you would expect to find in a more sophisticated radio and at a lower price. It lacks only some extra switches to turn its multitude of functions on and off.

All in all, the RD6000 is a great unit that's available at a great price. For those who want to at last take the leap into computer radios, this design has been optimized for ease of use.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.* ✦

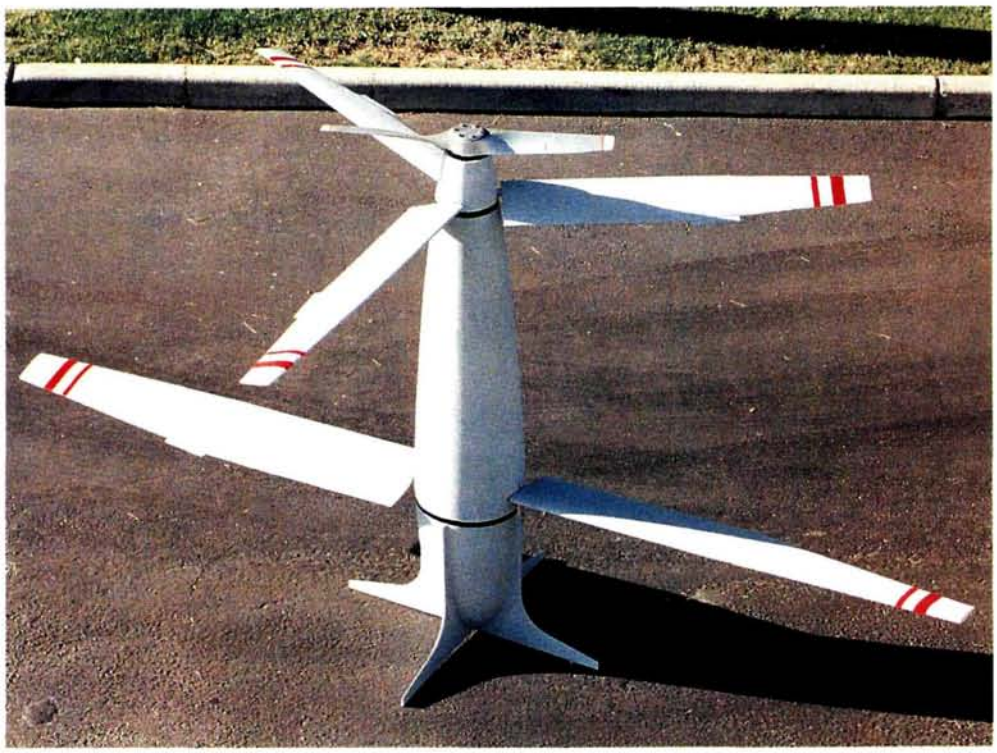
THE Spinwing

by Tom Atwood

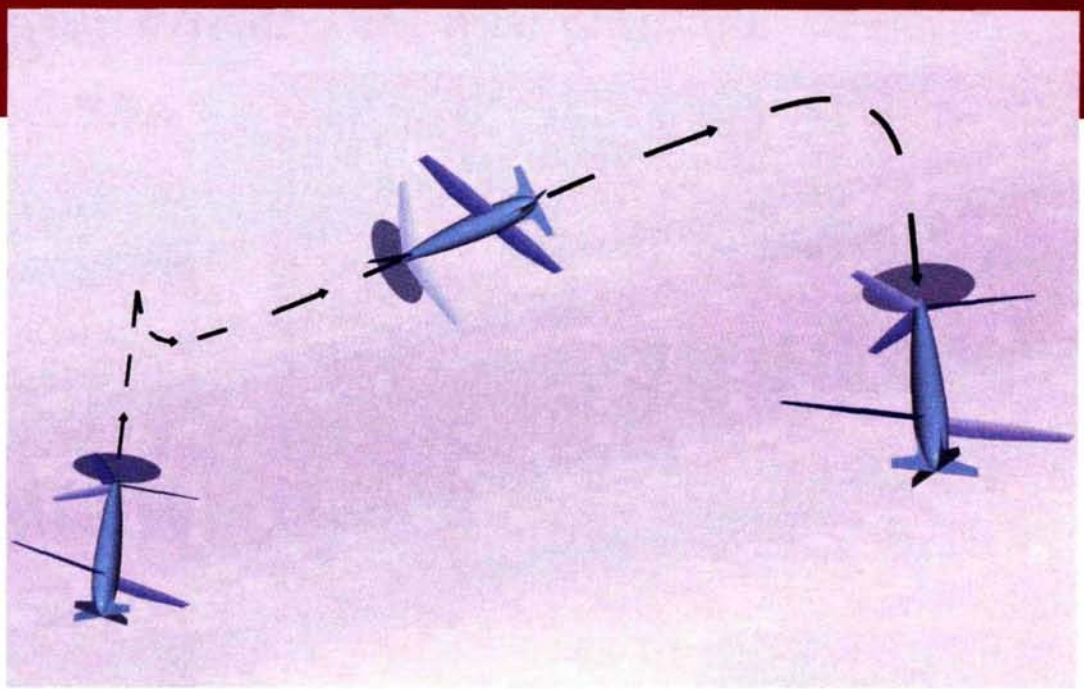
World's first flying "stop-rotor" R/C aircraft

Spinwing's creator, W.R. "Randy" McDonnell, left, is shown holding the Spinwing vehicle as it appears in airplane mode. The 122-inch span wing is steadied by Victor Castioni. Airplane propulsion is provided by the pusher propeller located aft of the tail-fin assembly.

The "Spinwing" is the world's first and only flying "stop-rotor" R/C aircraft. This extraordinary machine has the remarkable ability to slowly or rapidly convert between helicopter and airplane flight modes—and can therefore realize the benefits of either hovering or horizontal flight. It does not require prepared landing areas yet is able to sustain long endurance flight profiles at high dash speeds.



The Spinwing launches and recovers in helicopter mode by setting the pitch of the tail fins and wings as shown. Since there is no need for a tail rotor, all engine power is used to lift the vehicle. Thus, the Spinwing has significant payload capacity in hover.



The Spinwing takes off in helicopter mode with the tail fins and wings pitched and spinning so as to provide lift and counterbalance the torque generated by the lifting rotor. The craft then slides downward as the wings and tail fins rotate into position to support horizontal flight. A pusher prop powers the airplane in horizontal flight. Landing is accomplished in hover mode after a pushover maneuver.

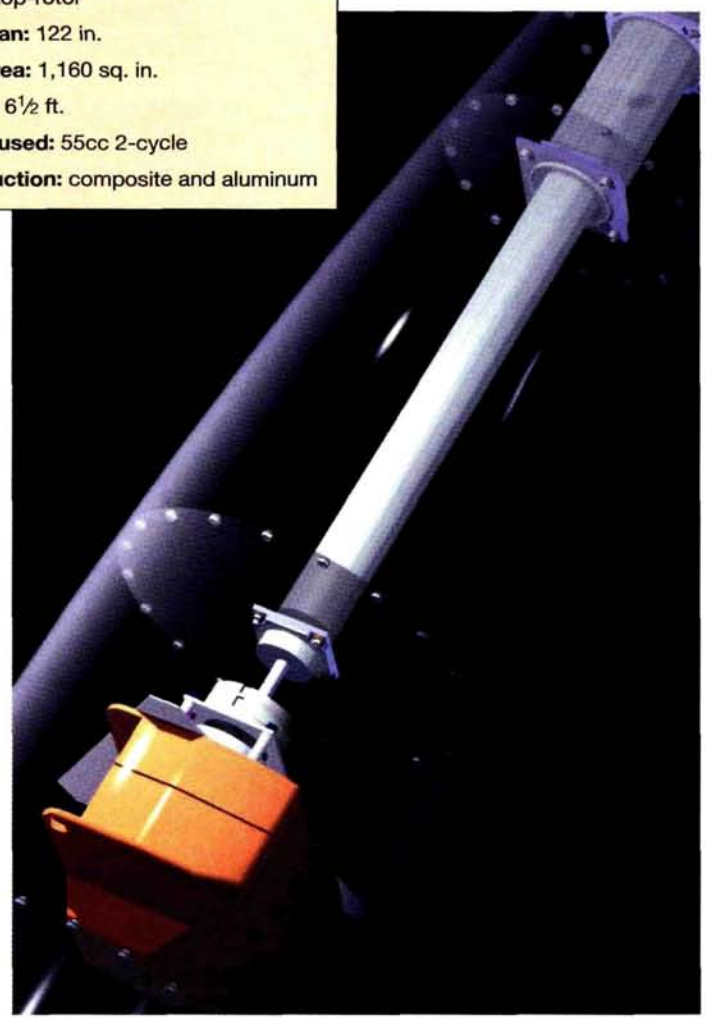
SPECIFICATIONS

Name: Spinwing
Type: stop-rotor
Wingspan: 122 in.
Wing area: 1,160 sq. in.
Length: 6½ ft.
Engine used: 55cc 2-cycle
Construction: composite and aluminum

Because of its unique configuration, the Spinwing eliminates rotor and wing pylon and secondary lifting surface mechanics typical of competing tiltwing and tiltrotor designs. The Spinwing in effect combines helicopter and airplane advantages while avoiding each category's limitations.

The Spinwing was invented by the creative mind of W.R. "Randy" McDonnell of Advanced Aerospace Technologies Inc. (AATI), and is being further developed in a collaboration between AATI and its partner, the Thorpe SEE-OP Corp. of Mesa, AZ.

During hovering flight, the tail wings are driven much like a helicopter rotor, and the main wings counter-rotate to offset consequent torque. During horizontal flight, the main and tail wings operate like conventional aircraft wings, and a pusher propeller drives the airplane forward. Flight tests were completed on a concept demonstrator in St. Louis, MO, during the summer of 1996, and further testing of technology demonstrators have continued into 1999 in Mesa. Potential uses of this R/C aircraft include search and rescue missions and a wide variety of environmental, research and law enforcement applications. Studies are underway to determine scaling options for larger Spinwing vehicles.



Left: cutaway view of the internal mechanics of a portion of the drive train.

To see images of prototypes in flight as well as AVI videos of flight mode conversions, see the Spinwing website at www.seeop.com. For further information, contact Doug Thorpe at Thorpe SEE-OP Corp., 320 S. Nina, Ste. 14, Mesa, AZ 85210; (602) 969-2021; email: thorpe@seeop.com.

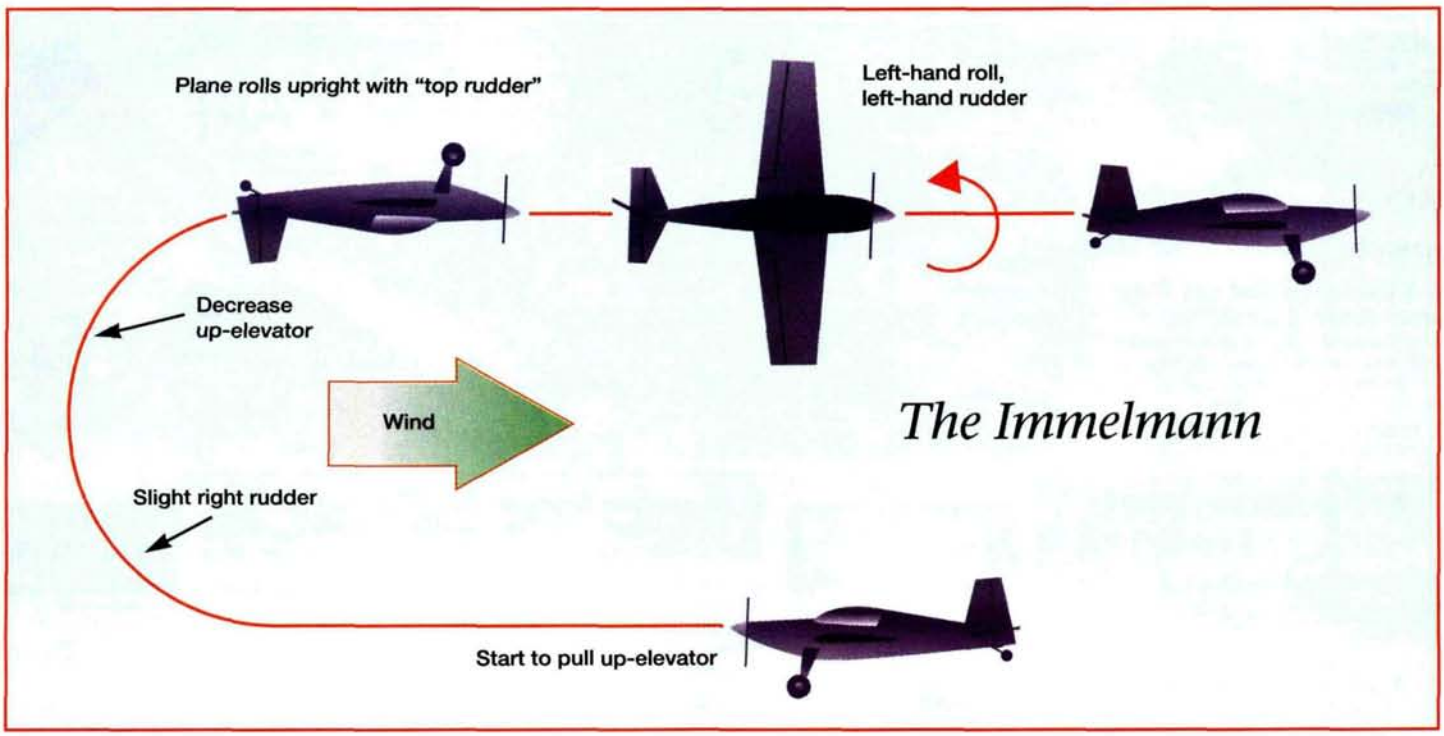
by Dan Wolanski

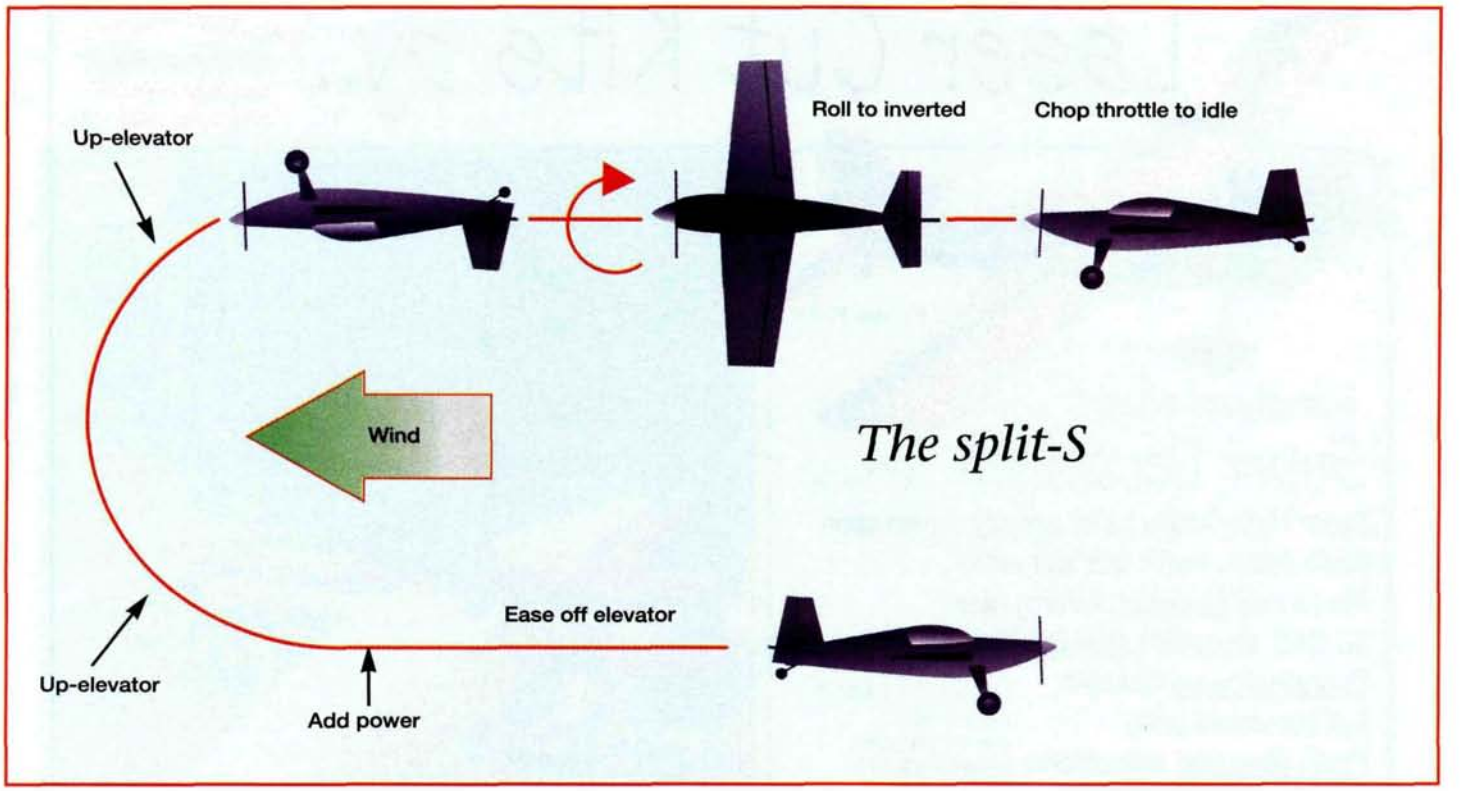
IMAC Aerobatics:

Perfect your turnaround maneuvers

THE IMMELMANN AND SPLIT-S are the foundation turnaround maneuvers of every aerobatic sequence, whether full scale or miniature. Each turns the airplane around in the aerobatic zone and adjusts the altitude for the next maneuver. All too often, these maneuvers are overlooked because they seem so easy. I have watched the most seasoned pilots botch an Immelmann or split-S because they are thinking about the next maneuver in the sequence. Half loops and rolls sound simple, but without the proper timing, throttle setting and wind correction, these maneuvers are an easy way to lose precious points.

The Immelmann is described as a half loop followed by an immediate half roll. The roll must take place at the apex of the half loop. Points are deducted for flying inverted for any distance. The split-S is sort of the reverse of an Immelmann. It is described as a half roll followed immediately by a half loop. Once again, flying





inverted before commencing the half loop is cause for point deduction.

FLYING THE MANEUVERS

Let's start with the Immelmann, by far the harder of the two maneuvers. First, get the plane out approximately 100 yards away, flying parallel to the runway. Be sure to fly into the wind and go past the center of the aerobatic zone. Now apply full throttle and begin to pull the plane into a nice loop with a constant radius. As you add elevator, you may need a little right rudder to keep the plane on track, but don't apply too much or it will slow the plane down. Also, the radius of the loop should be at least 100 feet (a presentation tip—not a requirement!). As the plane goes past true vertical, start to decrease up-elevator. Your plane will now be traveling much more slowly than it did when you entered the maneuver and will be very susceptible to wind drift. Be sure to stay on top of any wind correction with your rudder. Also, if you notice that a wing is down during the maneuver, correct it with opposite rudder—not your ailerons. As you approach the top of the half loop, your plane will be traveling very slow and downwind. If you merely bang the ailerons to roll upright, your nose will drop because of the slow airspeed. To fix this, apply "top rudder" during your roll to upright. "Top rudder" is the gradual but quick application of rudder as the plane passes through knife-edge to maintain a nose-up attitude. When you are inverted, top rudder is always applied in the same direction of your roll. For example, if you always roll right to upright, poke a little right rudder in as the plane passes through knife-edge. Finish the Immelmann with a little bit of up-elevator to keep your elevation.

The split-S is a much easier maneuver, but it does have a few tricky parts. The most important component is your throttle setting. Once again, take your plane to the end of the aerobatic zone at approximately ⅔ throttle. Be sure you are at least 300 feet high, then chop the throttle. Immediately roll the plane to inverted. Because you chopped the throttle and rolled almost simultaneously, your model's nose should start to drop all by itself because of the loss in airspeed. As the plane descends to the bottom of the half, gradually apply up-elevator. As you approach the end of the maneuver, begin to gradually add power and ease off the elevator.

SCORING

A perfect score for any maneuver is a 10. International Miniature Aerobatic Club (IMAC) downgrades are one point for every 10-degree deviation from the programmed line of flight. The downgrades are applicable for each axis (roll, pitch and yaw) and are cumulative. For example, if you attempt to pull your plane to a vertical climb, and your roll, pitch and yaw are each off 10 degrees, you will incur a three-point deduction. Errors are rarely ever that large and are more likely to be a few degrees on one or two of the axes. Half-point downgrades are given when the cumulative variation is 5 degrees. Special note: all maneuvers, including vertical lines, will be judged as wind-corrected maneuvers. This means that the judges will look at the path of the plane with respect to the ground. For example, if there is a crosswind, your plane will need to "crab" into the wind at all times to maintain the constant distance away from the pilot. This includes vertical lines.

While scoring these maneuvers, judges watch to make sure that your rolls occur exactly where they should. Flying inverted for any distance will earn you a quick one- or two-point deduction. When you fly the Immelmann, the judges will also watch very closely to see whether your model's nose drops at the end. If it does, deduct another point. If the drop is severe, deduct two. The judges will also look for a nice, constant radius; not maintaining your radius will cost you another point or two.

VARIATIONS

It never ceases to amaze me how many ways you can disguise these maneuvers. Throwing in snaps and point rolls before and after the half loop is fair play in IMAC sequences. The 1999 Sportsman sequence, maneuver no. 10, has a 2- of 4-point entry into a split-S; then, just for kicks, there's a ½ roll at the end to provide an inverted exit. Maneuver no. 10 in the Unlimited sequence has a ½ roll, 1½ snap entry to a split-S, followed with a 2-point roll. Yes, that's all one maneuver! Just think; if you never learned how to perform the basic Immelmann or split-S, your chances of getting anything more than a 2 or 3 would be hopeless! Have fun practicing the Immelmann and split-S. Make sure that you don't overlook these foundation maneuvers, or they will come back to haunt you someday! *[Editor's note: for more information on IMAC aerobatics, check out their website at www.mini-iac.com.]*

MODEL AIRPLANE NEWS
HOW TO

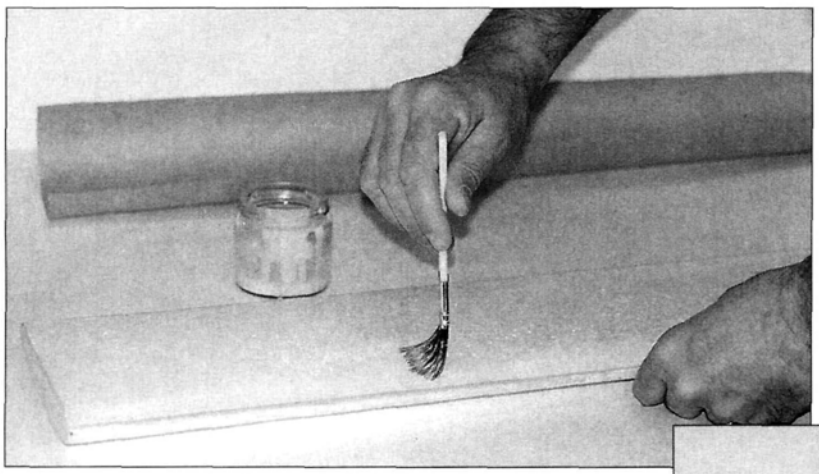
A strong and inexpensive method

Sheet Foam Wings with Plain Brown Paper

by Bertil Klintbom

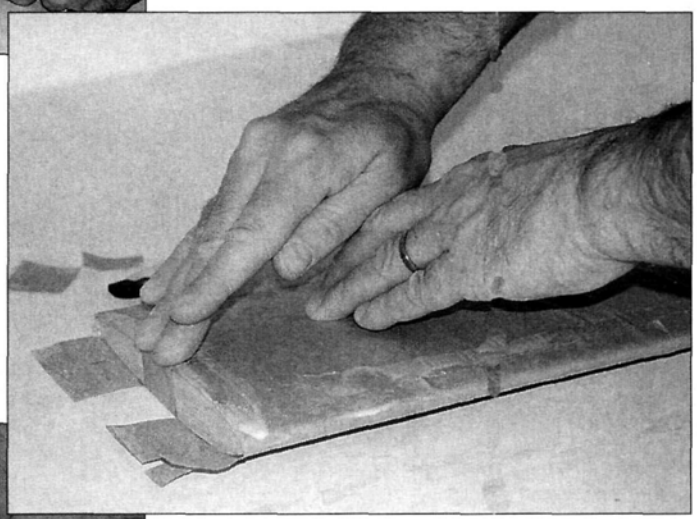
PHOTOS BY BERTIL KLINTBOM

You can create a perfect finish with brown wrapping paper. This method is easy, low-cost and creates a clean, strong surface that's very tough and resists punctures. If you like, you can cover an entire model this way! I covered the wing and parts of the fuselage of my 1/8-scale Casa 212 Aviocar this way.



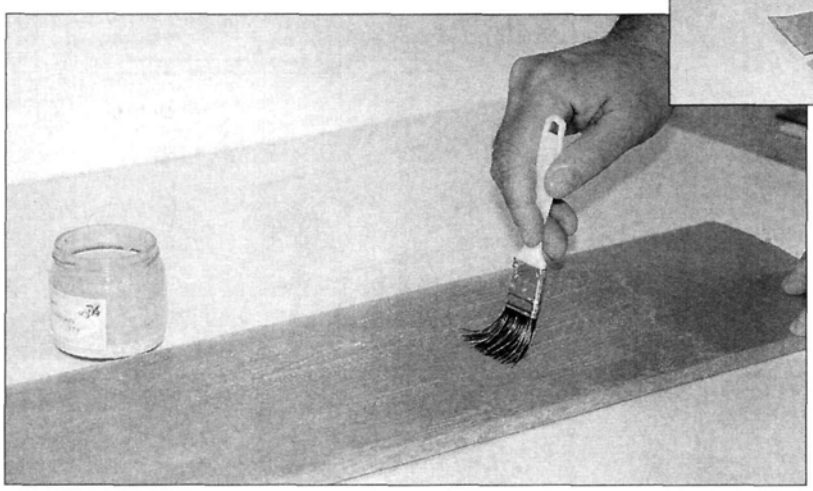
1 Add leading and trailing edges and the wingtip to the foam-core. Mix regular white glue 50:50 with water and add some food coloring. Cut the brown wrapping paper so that the top sheet is 1 inch wider than the foam-core, and the bottom sheet is slightly smaller than the chord of the foam-core. If there is a "grain" to the paper, it should be positioned spanwise.

Apply the glue mixture to the foam-core; you can see why you need to color it! Coat both sides of the foam-core and the matte side of the paper with the glue mixture.

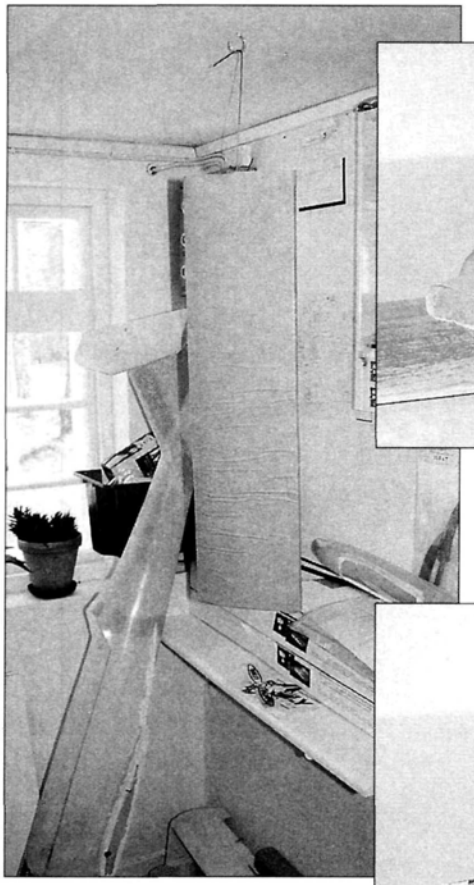


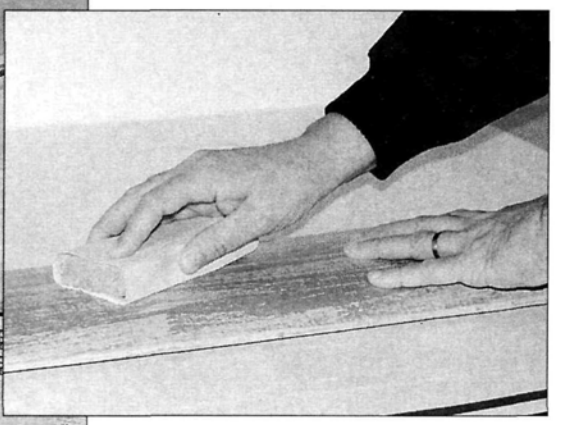
2 Position the paper on the foam-core. Start with the underside and continue with the upper surface. The upper sheet should overlap the edges and the bottom sheet. Smooth out the paper with your hands and work quickly, before the paper gets too wet. Make sure to cover both sides of the foam-core!

Cut the paper at the wingtip and root and fold small pieces of it up over the side to the bottom surface. If you have a rounded wingtip, simply cut darts in the paper and let the pieces overlap.



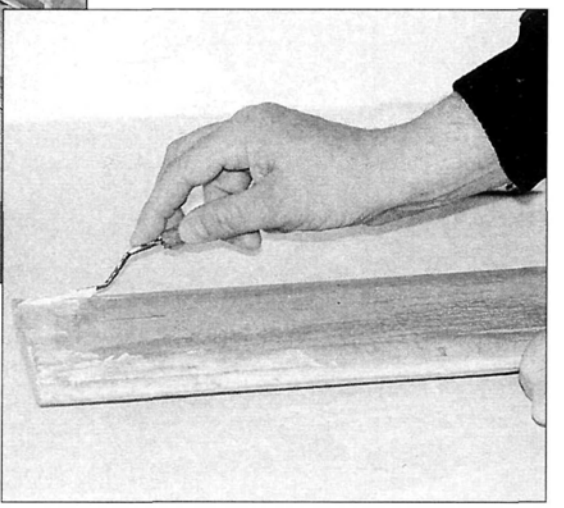
3 After you've covered the wing, it will start to wrinkle and will look awful: a total disappointment! No problem; hang it to dry for 24 hours, and it will become smooth again.



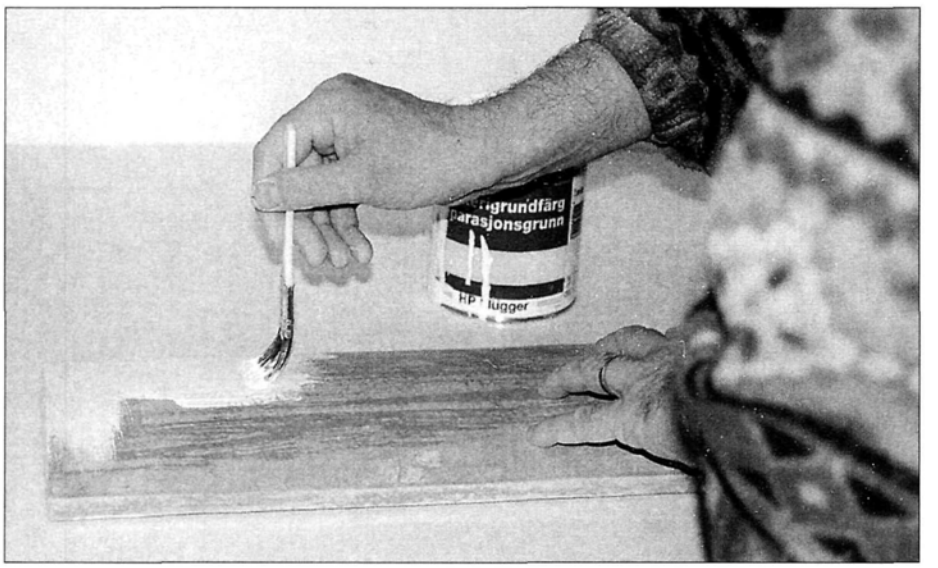


5 After the wing has completely dried for the third time, dry-sand it. Be careful not to cut into the paper surface.

4 After the wing has completely dried, coat it with a mixture of 50:50 water and white glue. The cover will wrinkle again, but hang it to dry, then repeat this process once more.



6 Fill out the paper joints with lightweight filler, and after the wing has dried, sand the joints and add more filler if needed.



7 When you are satisfied with the surface, continue with a primer and paint as usual. If you wet-sand the wing, be sure you have a good coat of primer on the surface.

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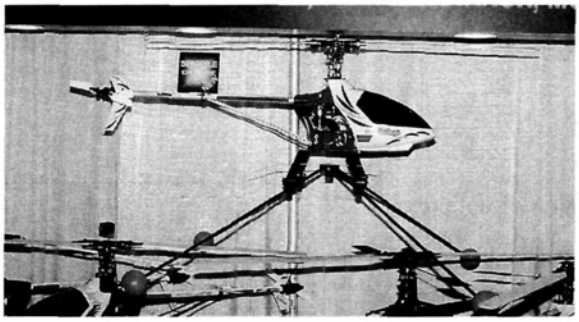
Everytime we sit down to do a new ad, we don't know where to begin. If we do an ad about our battery packs, people call wondering if we're no longer making kits or publishing *R/C Techniques* and *Electric Flight Techniques*. If we do an ad about our kits, people think we're no longer making battery packs for modelers or that we've stopped pubishing *Techniques*. It often seems like there's no right way to keep you informed about what's new at SR Batteries. • Well, all of that has changed! Thanks to the world wide web, WWW, we can now not only keep you up to date, we can keep you up to the minute! If we release a new kit, you'll read about it two or three *months* sooner at srbatteries.com . If we release a new *Techniques* volume, you'll read about it two or three *months* sooner at srbatteries.com . And finally, if we release a new cell or technical information about one of our packs, you'll read all about it *first* at srbatteries.com! Naturally, our site lists pricing and technical information covering all of our products. You'll find the sizes and weights of all of our packs and individual cells as well as photos, specifications, and descriptions of our ARF and laser cut kits. In addition, there's a detailed index to all of the volumes in the *Techniques* library. • SR Batteries, Inc., Box 287, Bellport, NY 11713, Phone: 516-286-0079, Email: info@srbatteries.com

Heli highlights from the trade shows

TRADE SHOWS ARE GREAT PLACES to see the very newest of heli products; I attend several every year, including the WRAM show in Westchester, NY, and the granddaddy of all shows—the one in Toledo, OH. I've been attending these shows longer than I care to remember, and I always come away pleased that I made the trip. For this column, I thought I'd share some of the highlights of these recent shows.



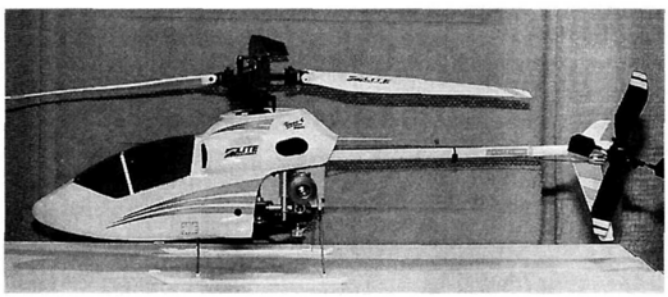
The Hirobo Shuttle Challenge, a beginner's heli that comes with a redesigned rotor head and articulated training gear.

NEW STUFF

One thing can be said about both shows: there were many new products on display for helicopter enthusiasts. My first stop at the WRAM show was the Hirobo* booth, where Jeff Green was displaying the new Shuttle Challenge. Designed for the beginner, the Challenge is a totally new concept in helicopter layout based on the well-proven Shuttle design. Features include a new rotor head with softer seesaw/mixing-arm geometry, heavier flybar paddles and adjustable flybar weights. All of this combined with new pitch arms on the blade grips produces a stable rotor head that is very forgiving. The most obvious feature, though, is the fully articulated training landing gear. The gear pivots up and down and prevents the heli from tipping over; no more main rotor or tail-blade strikes! Having flown the prototype at last year's Hirobo Cup, I can say that the system works very well. Once hovering has been mastered, the training gear can be removed and replaced with conventional landing gear.

Rocky Strohl proudly displays the new 30-size Thunder Tiger Raptor.

Down the aisle, I spied the cute Lite Machines LMH helicopter. This neat little ½A-class heli is an inexpensive, fixed-pitch design that is also aimed at the beginner. Some features include flexible main rotor blades that fold up on impact and the Arlton gyro stabilizer that's built directly into the tail rotor; no electronic gyro is needed. Power for this heli is provided by a Norvel* Vmax-6 engine. This ½A engine is a powerhouse that's economical and easy to run.



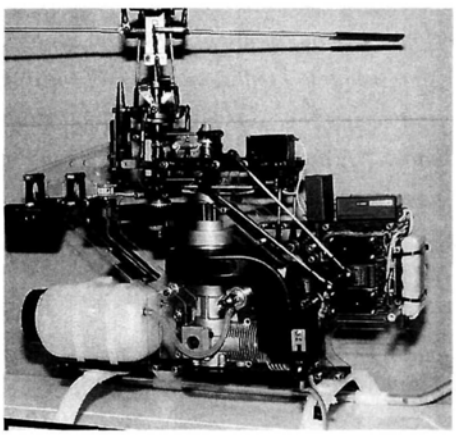
The LMH Model 110 is a small, entry level heli that's easy on the pocketbook; no electronic gyro needed.

Another new heli on the market is the Thunder Tiger* .30-size Raptor. Designed by Mr. Taya (designer of the original Concept 30), this heli has many innovative features and is available in kit form or fully assembled. Many R/C'ers are already flying the Raptor and saying good things about it.

Following the success of its popular Intrepid heli, Bergen Machine & Tool* introduced a new .46-size heli that shares many features with its bigger brother. I look forward to seeing the Intrepid 46 in action this year and will let you know what I see.

Kalt* made a strong showing this year and debuted its new, top-of-the-line, .60-size Mercury heli. The main feature of this heli is its cyclic/collective pitch mixing (CCPM) that eliminates mechanical mixing of the controls and uses servos mounted directly under the swashplate for direct cyclic and collective control. This system eliminates many parts and results in a tighter, almost slop-free control.

The new Bergen Machine Intrepid 46 is a smaller version of the popular .60-size Intrepid heli.



Close-up details of the Intrepid .46 mechanics.

JR*, maker of the popular Ergo helicopters, has also added CCPM control to the Ergo line, including the Ergo 30, Ergo 46 and a semi-scale Schweizer 300 based on the .30-size Ergo chassis. All feature the same robust construction for which the Ergos are known. Later this year, conversion kits will be available to convert the standard Ergo 30 and Ergo 46 to CCPM control. Also new at the JR booth were a Schweizer 300 conversion kit for the Ergo

Sport 60 and a nice-looking Bell Long Ranger conversion for the Ergo 46. The 300 has a factory-painted fiberglass fuselage and canopy and features scale landing gear. The Long Ranger has a lightweight fiberglass fuselage that quickly transforms the "pod and boom" Ergo 46 into a great-looking scale ship. I have an Ergo 46/Long Ranger conversion under construction and will report more on it as things go together.

For the serious scale helicopter enthusiast, the Vario* booth was the place to be, as the company had many great-looking fuselages on display. If you're interested in scale, Vario most likely will have something you're looking for. It also has an extensive line of scale accessories and mechanics to fit every scale whim.

Left: the new Kalt Mercury features CCPM mixing control. Right: Joe Howard displays the Vario Tiger. The Tiger is part of Vario's growing line of scale bodies intended for the scale-minded heli modeler.

At Toledo, Great Planes* introduced the new Kyosho Caliber 60 (another CCPM helicopter). Some features of this FAI-competition machine include a "ladder frame" chassis milled from aluminum and carbon fiber, a belt-driven tail rotor and pull/pull pushrods on all controls including the tail rotor. Great Planes also had its Heli-Max line of piezo gyros and a new rotor head speed governor on display. Particularly impressive were its micro gyro that weighs only 0.50 ounce (14 grams) and a "heading hold" piezo gyro intended for the 3D pilot.

If you're into simulators, you'll be interested to know that the GP's Real Flight simulator now has a helicopter add-on. The graphics are stunning, to say the least, and the add-on should be available this summer.

Hobbies & Helis Intl.* had on hand new .30- and .46-size helis from Quick. Quick has long been known for its high-quality parts, and its new, mid-size TSK heli should be very popular. It, too, features CCPM control and all-metal construction.

I think the trend this year is definitely toward CCPM control; all of the major manufacturers have introduced it to their heli lines. CCPM has been used in Europe for many years, and our new computer radios support it so I think its time has come. Well, I've run out of room for this time; if you have any questions or comments, I can be reached through the magazine at 100 East Ridge, Ridgefield, CT O6877, or at man@airage.com. As always, remember to fly safely.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.* ✈

PHOTOS BY SYD KELLAND

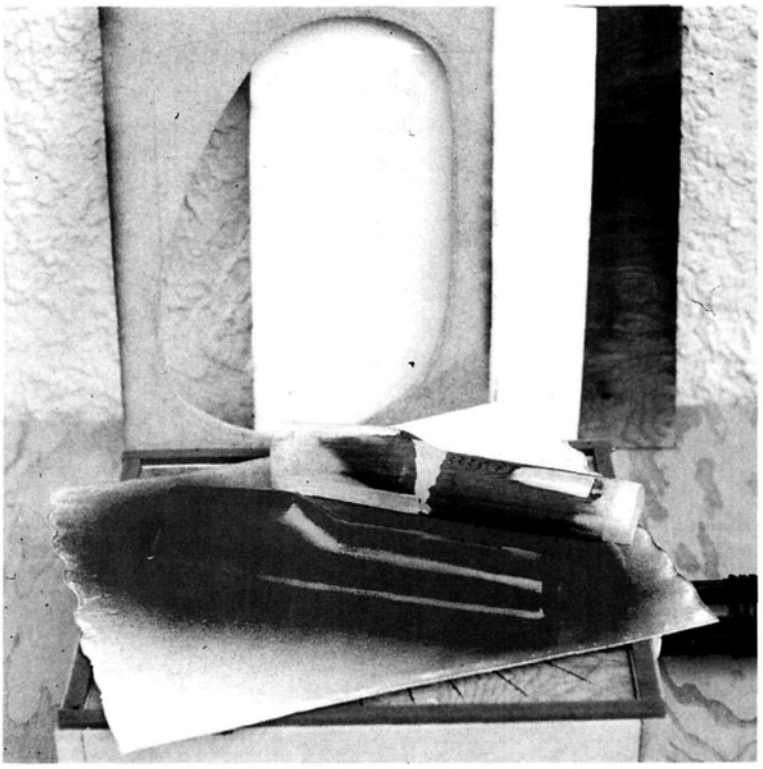
Easy Vacuum-Forming

by Syd Kelland

Fire up the backyard grill!

VACUUM-FORMING your own canopies, wingtips, cowls and wheel pants is easier than you might think. Here are some of the secrets that will help you through the process and keep trial and error to a minimum.

I use a wooden vacuum box, my shop vac, a gas barbecue grill, the piece to be molded (called a plug) and some 20-gauge (ga) sheet plastic stapled to a plywood frame. I use the gas grill to heat the plastic because I like to work outside, but a kitchen oven will work just as well. I'm overly cautious when it comes to potentially harmful vapors that may be released when heating plastic.



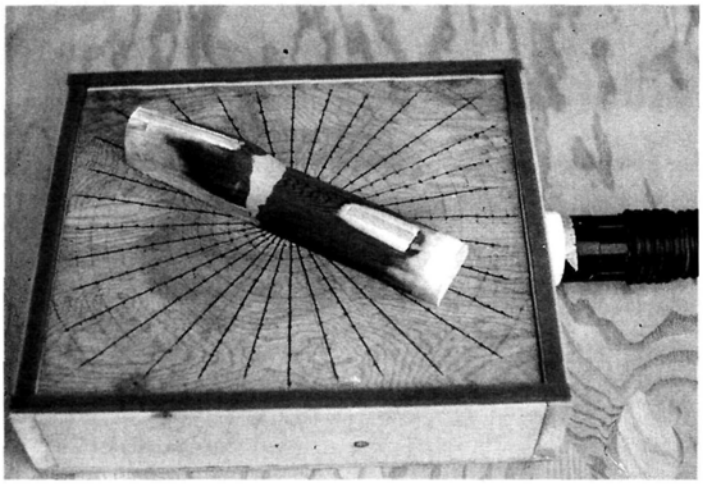
THE VACUUM BOX

My airtight, 16x18-inch vacuum box is made of 1x4-inch lumber for the sides and ¼-inch-thick plywood for the top and bottom. In the top plywood piece, I drilled a pattern of ⅛-inch-diameter holes roughly ½ inch apart, radiating outward from the center point, and then I joined them with 1/16-inch-deep grooves made with my Dremel* tool and a cutoff wheel. I then glued a section of plastic pipe that accepts the hose from my shop vac into a hole on the side of the box. This is where the vacuum comes from.

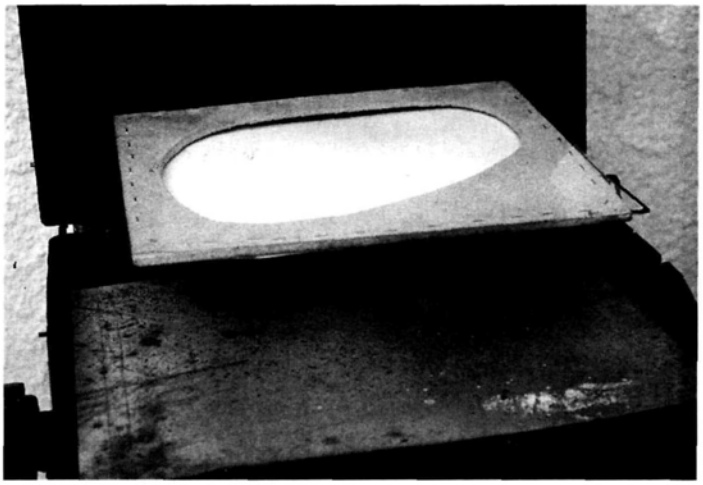
On top of the box, around its perimeter, I added ½-inch foam weatherstripping tape, which will ensure a good, airtight seal over the entire working surface when I lay the hot plastic on top. Using my ordinary shop vac, I have been able to draw hot plastic down over a 3-inch plug without difficulty.

THE PLUG

Plugs can be made out of almost any material that you like to carve, as long as it can hold its shape under heat and moderate pressure. I carve plugs out of soft wood and then sand them down to the shape I want. I also like to use auto-body filler to add detail and build up any areas



The plug is in position on top of the wooden vacuum box. The shop vac is connected through a hole on its side, and the weather-stripping ensures a good, airtight seal. Note the pattern of holes drilled in the top of the 16x18-inch vacuum box.



The plastic "sandwich" on the upper rack of the gas grill. The sheet metal on the grill ensures a more even heat distribution. I used a staple gun to secure the clear plastic sheet to the plywood frame.

on the plug that need extra attention; the putty sets up quickly, is easily shaped with a rasp and can be sanded to a nice, smooth finish. If you make a plug out of foam, you will have to cover it with at least ¼ inch of plaster or body filler to protect it from the hot plastic.

Coat the plug with a thin oil film, which will work as a release agent. Do not use wax as a mold-release agent because the wax will stick to your plug like glue; trust me on this.

THE PLASTIC

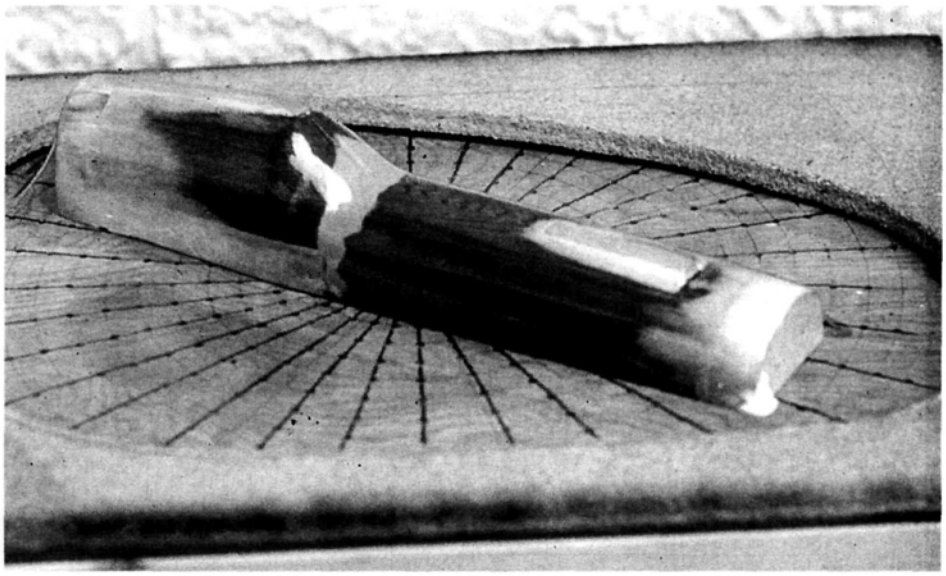
Check the "Yellow Pages" for a local plastics supplier; you'll need 20ga styrene sheets (the least expensive and easiest to work with), calendar vinyl and PET-G, ABS, TXP, or any other material suitable for thermal forming. Sheets typically measure 3x6 feet and cost $5 to $20 each, depending on the type of material. Styrene is white, and PET-G and TXP are clear and more suitable for canopies. (This is the kind of rigid, plastic sheet you see formed around consumer electronics products.)

I rough-cut the plastic sheet to the same size as the top of the vacuum box. By doing this, I ensure that there is a good, airtight seal between the hot plastic sheet and the weather-stripping around the vacuum box.

FIRE UP THE BARBECUE

To vacuum-form successfully, it's important to heat your sheet plastic as evenly and as thoroughly as possible. To achieve an even heat distribution on my gas grill, I cover the entire area just above the fake briquettes with a piece of ⅛-inch-thick sheet metal.

Another tip is to make sure the perimeter of the sheet is secured to a wooden frame. I staple the sheet to a piece of ½-inch-thick plywood that's the same size as the top of the vacuum box and has a large cutout in its center. If the plastic is not secured to this frame, it will be deformed (warped) when it's heated. I place the frame on top of a supporting piece of ¼-inch-thick plywood that has a single sheet of paper on top. I put this assembly on the upper warming rack of the grill and then close the lid. The supporting sheet of plywood prevents the warm, sagging plastic from touching any metal inside the grill; if it touched, it would surely melt and make one heck of a mess! The paper prevents the hot plastic from melting onto the supporting plywood sheet.



Another clear canopy and forward fuselage section is vacuum-formed over the plug.

I keep the temperature inside the grill at around 375 degrees Fahrenheit and set my timer for 3 to 5 minutes as soon as I close the grill's lid. This is not an exact science, but by using a fairly constant temperature, I can vary the "grilling time" for different types and thicknesses of plastic sheet. After 3 to 5 minutes in the grill, the plastic sheet is quite soft and ready to be quickly placed on top of the plug.

Place the plug onto the center of the vacuum box and attach the shop vac. Apply firm pressure to the frame so that it is sealed tightly against the weather-stripping, and then turn on the vac. (A foot switch or a helper comes in handy here.) After just 2 or 3 seconds, the hot plastic will be sucked down tightly around the plug; in another 20 seconds or so, the plastic sheet will have cooled enough to keep its shape.

Turn the shop vac off and remove the finished product from the plywood frame. Trim off the excess material, and that's all there is to it! You could easily make 20 or 30 duplicate canopies in an afternoon using this method.

One of these days, I'll make a larger vacuum box: maybe one that's big enough for a fuselage, but then I would have to figure out a more suitable way to heat up a really large sheet of plastic. Say ... pizza ovens are pretty big, aren't they?!

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

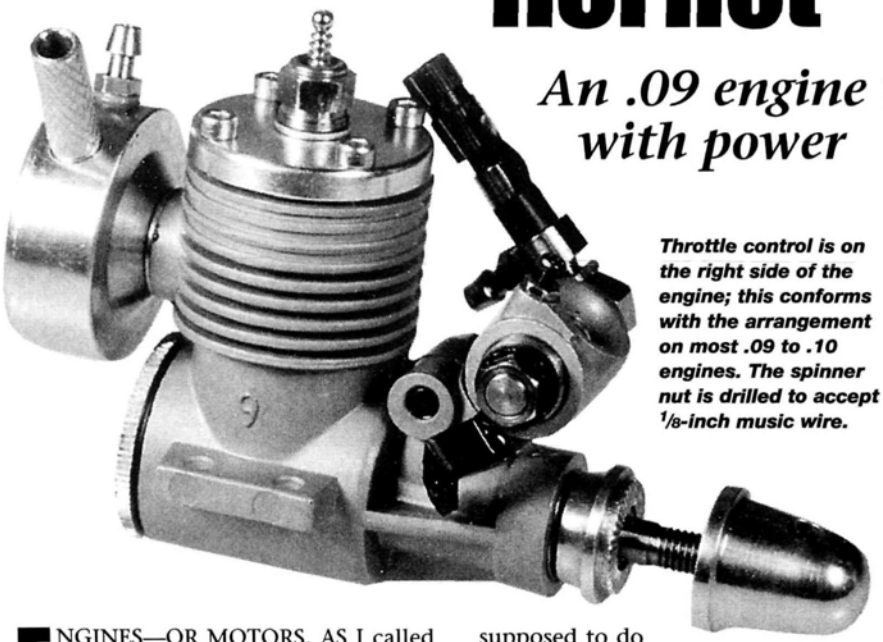
MODEL AIRPLANE NEWS
ENGINE
REVIEW

AP ENGINES

Hornet

An .09 engine that buzzes with power

by RANDY RANDOLPH



Throttle control is on the right side of the engine; this conforms with the arrangement on most .09 to .10 engines. The spinner nut is drilled to accept 1/8-inch music wire.

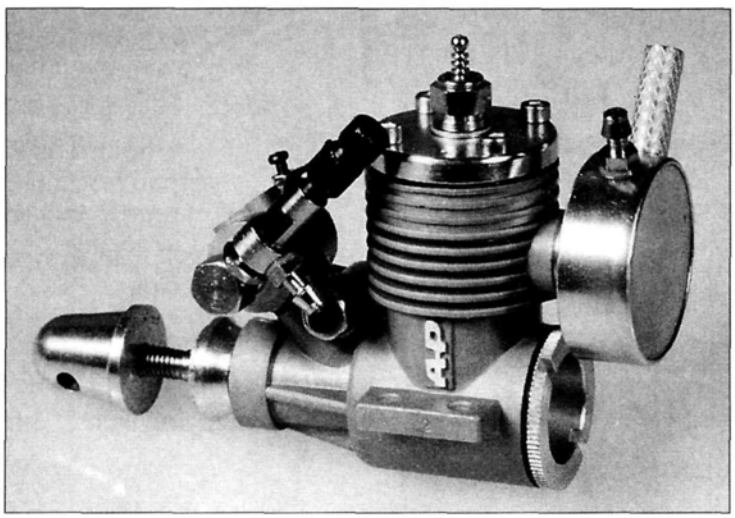
ENGINES—OR MOTORS, AS I called them prior to the advent of electric power for model airplanes—are pretty amazing things. It is interesting that something that pumps fuel from a tank, extracts some heat and spits the rest out of a hole in its head can make a propeller turn so fast. Even more interesting is that some engines do it better—and at less cost and effort—than others. Frankly, it's that last part that's most fascinating to me; I really don't care how it's done, just that it *is* done! If an engine does what it is supposed to do and is easy to handle, I'm happy. If it is cantankerous, expensive and needs a lot of maintenance, I can do without it regardless of its speed!

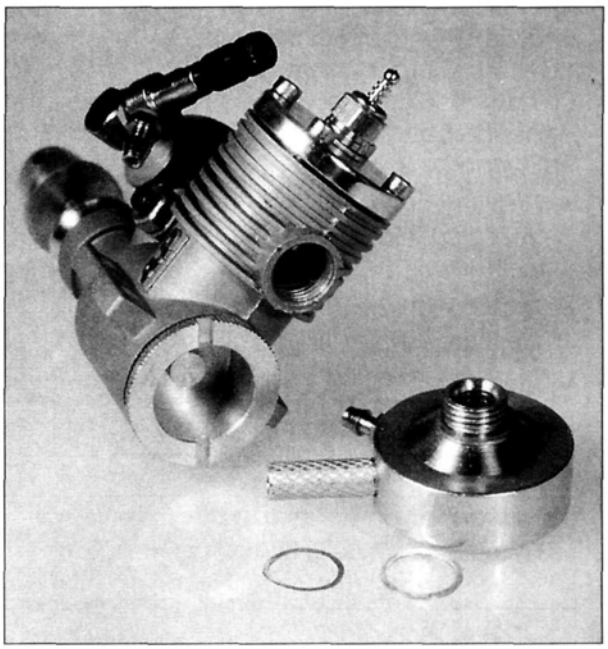
The AP Engines* Hornet .09 makes me happy. The most obvious thing about this engine is the needle valve that sticks up near the cylinder head. This is a nice design feature that gets it out of the way of the prop. Next is the rear-mounted, round muffler that is screwed onto the back of the cylinder. This requires a mount that is longer (1.8 inches) than the usual glass-filled .09 to .10 mounts. The engine comes with a couple of washers, or shims, that fit the shank of the muffler; these can be added or taken away so the muffler's exhaust outlet can rotate where you want it to.

The engine and muffler weigh 4.5 ounces, the same as most engines in this class. A spinner nut that matches most starters holds the prop on. For the record, this ABC engine has two ball bearings, Schneurle porting and conveniently uses an R/C short glow plug. The AP Hornet .09 is inexpensive and very well made; that means it should last a long time!

RUNNING THE ENGINE

Most of us use fuel with 10- to 15-percent nitro content; therefore,





Left: the angled needle valve, a nice touch for a small engine, keeps your fingers out of the prop. The needle is isolated from the rotating throttle barrel. Right: the muffler is screwed into the exhaust port; shims are provided so the exhaust outlet and pressure tap can be swiveled to their most convenient position.

describing how the .09 runs on high nitro (40 percent) fuel did not seem necessary. My results are based on fuel containing castor, synthetic oil and 10 percent nitro, the same fuel recommended by the manufacturer for break-in. I used the starting procedure described in the instructions. With the fuel tank connected to the carburetor and the tank breather connected to the muffler for pressure, I opened the needle valve 2½ turns and choked the engine by holding a finger over the exhaust outlet. After I had connected the glow plug, the engine started as soon as fuel reached the carburetor. Only minor adjustments were needed to secure a steady, rich run. In fact, the needle is not even critical; ¼ turn either way made little difference during all tests.

After about a half hour of following the break-in procedure, I fired up the tach and took some full-throttle readings. On the break-in prop—an APC 7x4—it read 13,000rpm; on an APC 7x3, 13,500. A Graupner 7x3 showed 14,000rpm, and a Top Flite 7x4 was just a shade under 13,000. The idle speed was solid and down around 4,700rpm on all of the props tested—even a 6x4, which tached at just a shade under 19,000. Naturally, these were all static readings. The performance in a fairly clean, 2-pound sport airplane with a wing loading of around 12 ounces per square foot showed the Graupner 7x3 and the APC 7x4 to be about equal, while the APC 7x3 and the Top Flite 7x4 finished second and third. The 6x4 sounded great in the air but lost out in overall performance when compared with the other propellers. (In a cleaner, smaller airplane, that might have been an entirely different story!) With all propellers and through all angles of climb and G-forces, both upright and inverted, the engine ran as smooth as silk.

This engine is very easy to fly and maintain, and it equals the power of any sport-type .09 to .10 engine I have flown. The throttle is smooth and holds steady in every range, down to and including a very nice idle. If I ever decide to build a small, glow-powered twin, a pair of these engines would be my choice.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

SPECIFICATIONS

Manufacturer: AP Engines
Distributor: Global Hobby Distributors
Type: 2-stroke R/C
Height: 2.56 in. (including glow plug)
Width: 1.45 in.
Crankcase width: 0.98 in.
Length: 1.57 in.
Weight: 4.5 oz. (with muffler)
Exhaust: Rear exit (with swivel outlet)
Bore: 0.49 in.
Stroke: 0.47 in.
Power output: 0.25bhp
Practical rpm range: 4,000 to 18,000
Retail price: $49.99

Measured performance using 10-percent nitro fuel:

Propeller	Rpm
APC 7x4	13,000
APC 7x3	13,500
Graupner 7x3	14,000
Idle speed	4,700

Features: precise CNC-machining, Schneurle porting, twin ball bearings, ABC (aluminum, brass, chrome) piston and sleeve, adjustable swivel muffler outlet, safe and convenient vertical needle-valve design.

Hits
- Uses standard-size R/C glow plug.
- Reliable idle.
- Broad, usable power band with smooth transition.
- Swiveling rear-mount muffler outlet.
- Big value for the dollar.

Misses
- Requires slightly longer engine mount (1.8 inches) than standard .09 and .10 glass mounts (*very* small concession for the convenience of the swiveling rear exhaust).

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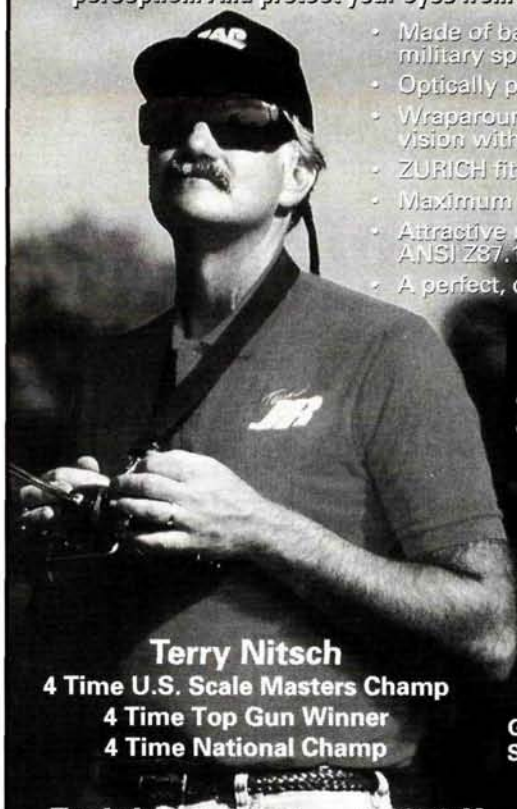

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Left: because the wing and canopy are glued on after the radio has been installed, leave a charging jack in the under-wing radiator so you can recharge the flight batteries.

Below: there is a lot of wing on the T-52, and it has a much better glide than expected and will thermal. The motor batteries are just under the leading edge of the wing.

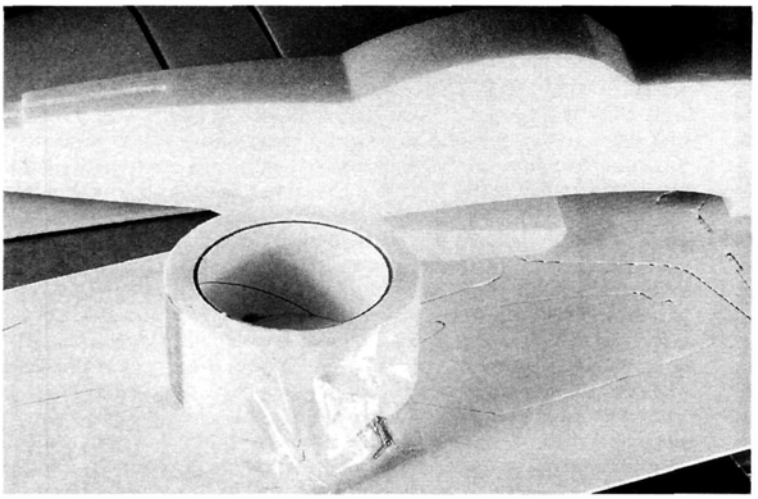
POCKET PLANE P-51 and FOAMIE T-52 Trainer

JK AEROTECH

Durable, low-buck sport models

by Randy Randolph

MANY YEARS AGO there was a saying, "What the world really needs is a good 10-cent cigar." Things change over the years, and now it would be difficult to find a stick of gum for a dime, much less a cigar! But for a relatively low price, you can get a good R/C model airplane from JK Aerotech*. In fact, you can get two: the Pocket Plane P-51 and the Foamie T-52 Trainer! These airplanes can be built quickly, take a lot of punishment, and when you get tired of patching them, just throw them away and build more!

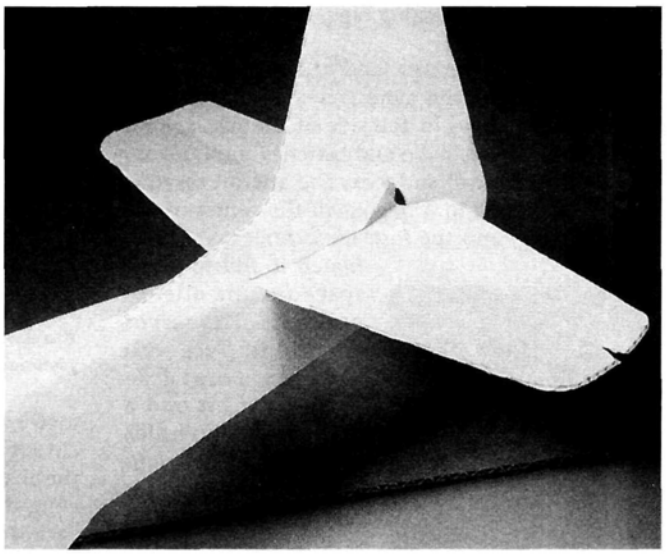


Basic kit includes hardware, foam fuselage, wings, die-cut tail feathers and a big roll of tape. Extras needed include spray adhesive, a small piece of plywood and nylon-reinforced tape.

Their basic structure is extruded pink foam, covered with and held together by colored packing tape. When finished, these models are rugged, and because the kits come with plenty of tape, the models are easy to repair. The P-51 can be powered with a .049 to .061 engine and is ideal for R/C combat because after a serious "accident," it can be back in service in time for the next sortie. The T-52 is a great sport and intermediate training model and can be powered with a .049 to .061 engine or a Speed 400 motor.

Building time is pretty short—about one evening!—because you simply poke holes into the fuselage and wing, and stick in the radio, servos, etc. If the sticky tape becomes wrinkled, as it did with my models, don't worry about it; the airplane will fly just fine anyway.

The kits come in plain boxes, and you get a finished foam fuselage and wings, die-cut tail surfaces and fuselage doublers, hardware, music wire for pushrods, hardwood dowels (if required), a big roll of colored packing tape and several sheets of instructions and hints on building and flying the airplane.



The tail feathers are easily assembled into the fuselage slots. Goop-type glue is recommended; I used epoxy and was very happy with the result.

TO THE WORKSHOP

I started with the P-51. Because both airplanes are assembled the same general way, I will outline differences when they apply.

Before starting construction, you will need a roll of nylon-reinforced filament tape. A can of 3-M 77 spray glue is also handy but not absolutely necessary. Most modelers will have the assorted knives and glue already on hand.

First, I made a big mistake and sanded the fuselage nice and round from nose to tail. The instructions warn about that, but some of us are such great craftsmen that we think we can improve upon just about everything. Believe me, when it came time to cover the model, I wished I had left it nice and square! The first step is to make a firewall out of a piece of 1/8- or 3/16-inch-thick plywood and epoxy it to the front of the foam fuselage. If you use the JK Aerotech Slickmount, drill the firewall before you epoxy it into place; it will be easier to drill out the foam behind it to make room for the tank. I used a 1 1/4-inch hole saw to drill the firewall and the foam, and it was a very easy engine/tank mounting exercise.

After you've installed the firewall, wrap the fuselage end to end with filament tape. Don't worry about covering up the hole in the firewall; the tape can be cut away later. The tape adds a lot of strength to the whole fuselage. Now glue the doublers to the fuselage sides with Goop or equivalent, then apply the colored tape just as though you were using iron-on covering! When the whole fuselage is covered, trim the tape away from the fin and stab slots.

TAIL AND WINGS

The rudder and stab are die-cut out of a corrugated plastic sheet. The stab and elevators are one piece, and the trick is to trim halfway through the bottom of the stab to form the hinge line for the elevator. (The T-52's rudder is treated the same way.) This works well and makes a hinge that is invisible from the top. Slip the stab through the slot in the fin/rudder, and then glue the whole works into the slots in the aft end of the fuselage. When complete, everything was nice and straight—just as

SPECIFICATIONS

Name: P-51 Pocket Plane and Foamie T-52 Trainer

Types: sport combat (P-51), sport trainer (T-52)

Manufacturer: JK Aerotech

Length: 20.5 in. (P-51), 31 in. (T-52)

Wingspan: 26 in. (P-51), 52 in. (T-52)

Wing area: 156 sq. in. (P-51), 364 sq. in. (T-52)

Weight: 12 oz. (P-51), 26 oz. (T-52)

Wing loading: 11.1 oz./sq. ft. (P-51), 10.6 oz./sq. ft. (T-52)

Power required: .049 to .061 engine (P-51), .049 to .061 engine or Speed 400 motor (T-52)

Power used: Cox Black Widow (P-51), Speed 400 direct drive and Lofty Pursuits LPSC-Mini speed controller and 6-600mAh battery pack (T-52)

Radio required: 2-channel

Radio used: FMA Fortress receiver w/ two S-90 servos (P-51), Ace receiver w/ two Futaba S-33 servos (T-52)

List prices: $22 (P-51), $29 (T-52), plus S&H

Features: each airplane comes with a squared-off foam fuselage, shaped wings and die-cut, corrugated-plastic tail surfaces. Each kit comes with instructions, pushrod wires, control horns and a large roll of colored packing tape for covering.

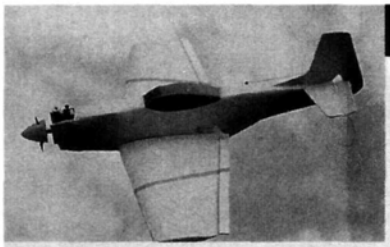
Comments: it takes a while to get the hang of covering the airplanes with the packing tape, but since there is plenty of it, there is no chance of running out while you learn. The finished airplanes are tough and can take a beating before they need to be taped up again!

Hits

- Good flying airplanes that look good in the air.
- Low maintenance, easy to repair.
- Good instructions.

Misses

- Not a very pretty box, but it's what's inside that counts!



FLIGHT PERFORMANCE

• Flying the P-51. Because it doesn't have throttle or landing gear, I hand-launched the P-51. With a Cox* Black Widow .049 up front, it nearly flew out of my hand. On the initial flight, it needed a little left and up trim to settle into level flight, and it took three passes down the runway to get the trim set. This airplane is small and moves fast, so an old guy like me has to turn a lot to keep it in sight! The P-51 is nice and stable, and it answers the controls quickly enough to be fun, but not so quick as to make you nervous. When it really hauls around, it will turn in a pretty tight circle. It will roll around the thrust line like a pattern airplane and do nice round loops. Inverted flight is OK but not its long suit. I was able to stall it a few times by keeping it in a long, steep climb, but it was more like a pause to get its breath than a stall. When I slowed it in a glide, it stalled rather quickly and took a little altitude to recover. It is best not to slow down a lot when landing; just fly it to the ground and hold it off!

All in all, this is a solid airplane that can be made to fly as though it's on rails and still cut up when required. It should be perfect for 1/2A combat, and with a Norvel* Big Mig up front, extra fast!

• Flying the T-52. This airplane has to be hand-launched as well. With the Speed 400 on direct drive, the climb was not all that spectacular, but after a few circles, it was twice as high as the trees that surround my schoolyard flying field, so it was going up pretty well. On the first flight, I didn't bother to trim it out because it seemed to fly just where I wanted it to go without much effort on my part. It is a smoothly responsive airplane that's nice and easy to fly. Under power, it needs to dive to complete a loop, and I couldn't get anything that looked like a roll. Stalls are gentle and straight ahead, yet I was able to get a one-turn spin after a stall by adding power, rudder and elevator at the same time. This is a pretty big airplane, and a gear drive on the Speed 400 and a larger prop would probably improve the performance. Even with all the hardware hanging out in the wind, the glide was pretty good! On one occasion, the model caught a little lift off the school building and acted just like a sailplane by gaining a few hundred feet with no effort at all. The stall in the glide is gentle and the glide itself fairly flat, with a landing slide of only a few feet on smooth grass. With an .049 to .061 engine up front, it should be quite frisky, and the glide would certainly improve if you removed two or three ounces of batteries. Oddly enough, neither airplane suffered any landing damage after several flights. The T-52 did pick up a little mud on the firewall when flying after a shower, but the tape bottoms were not even scratched!

it was supposed to be! The tail group can be covered with colored tape or left white. I covered the tail of the P-51 and left the tail of the T-52 white.

The wings have to be epoxied together at the center. There is an added center section in the T-52 wing so it will have a flat area in the middle to match the top of the cabin. After the glue has set, wrap packing tape around the joint and wrap several layers of filament tape around the wing, tip to tip. The tape acts as a spar and really strengthens the wing. When the colored tape is applied, the wing is strong, yet somewhat flexible. The P-51 has ailerons that are made out of strips of corrugated plastic and are hinged to the wing trailing edge with packing tape.

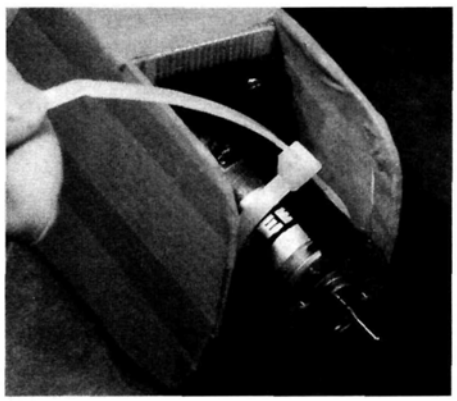
RADIO INSTALLATION

Installing the radio is a snap. Just dig out some holes in the side of the fuselage for the servos, radio and batteries and hook up the control surfaces. The aileron servo is mounted in a dugout in the center of the wing, and the fuselage is hollowed out to match it and to allow space for the aileron pushrods. The servos are held in place with servo tape. I used a 3/8-inch spade bit and a drill to make holes through the fuselage to allow connections for receiver, batteries and servos. Following the instructions, you first remove the canopy of the P-51, install the receiver and battery, then glue the canopy back into place. While the canopy was off, I painted it gray for a little contrast. After installing the aileron servo in the P-51 and making sure that the linkage works, glue the wing to the bottom of the fuselage.

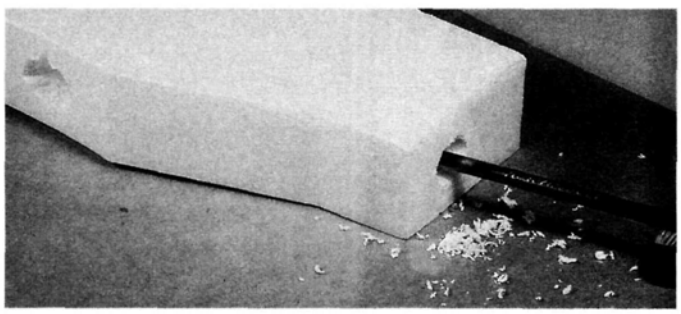
Both servos are external on the T-52, one on each side of the fuselage. I used a Speed 400 on a Graupner* motor mount to power the T-52. To make a cutout for the flight batteries, I followed the instructions and cut a slot below the wing that would just fit a 6-cell, 600mAh pack. I drilled a hole to link the motor to the speed control/BEC and another to link up the receiver. The connection to the battery was external, so I could slip the battery pack out and charge it without taking the wing from the airplane. Because two servos were hanging out in the wind, a few more wires didn't seem to make much difference! The wing on the T-52, which is considerably larger than the one on the P-51, is held onto the fuselage with rubber bands.

These airplanes are really something different in the R/C field. They are simple to build, and because of their foam-and-tape construction, they are nearly indestructible. If they are damaged, a few feet of tape will usually handle the repairs. Their return in performance is way above their price and effort to assemble them.

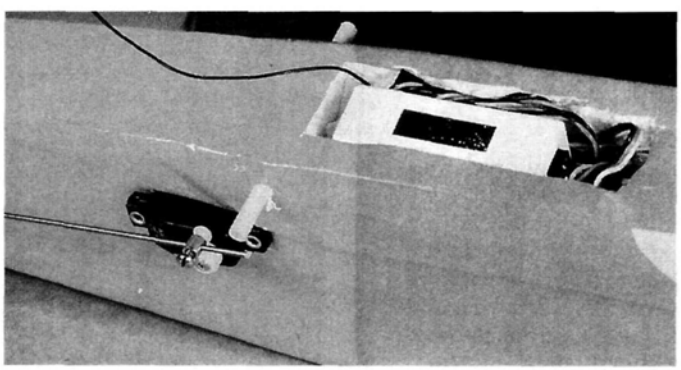
*Addresses are listed alphabetically in the Index of Manufacturers on page 150.



Nylon cable ties hold the Speed 400 onto the motor mount, which is screwed into the plywood firewall.

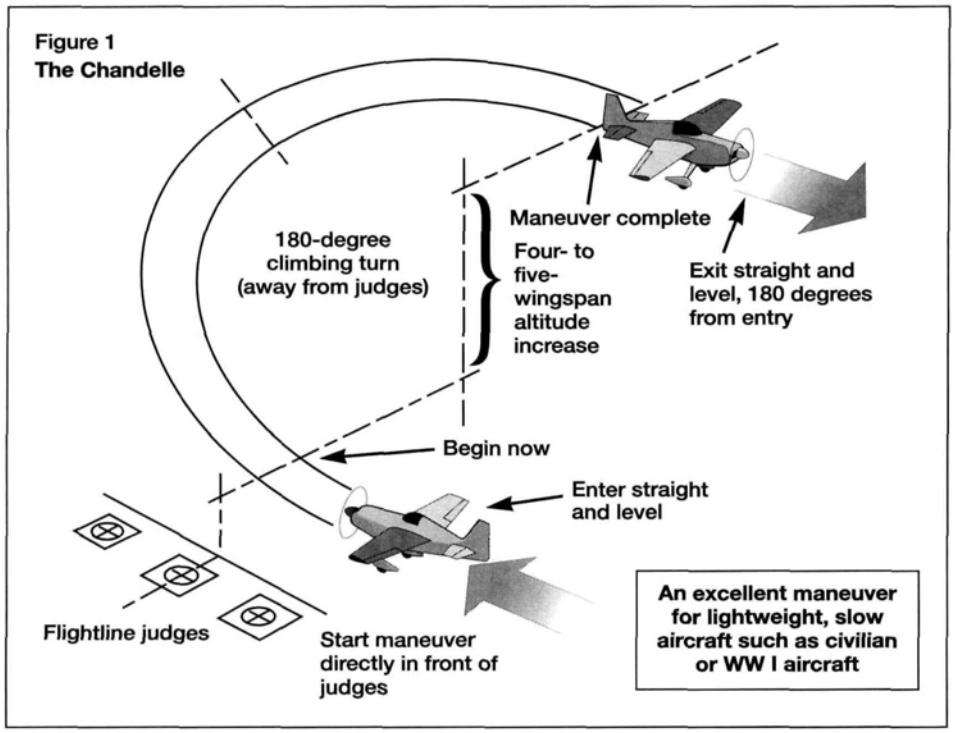


Because the T-52 was to be electric powered, I needed to make a pathway for the motor power leads. A 1/2-inch spade bit drilled a dandy hole from the firewall to the radio/speed controller area.



The servos on both airplanes are external, so you need only to dig holes into the fuselage sides. The receiver is under the wing in the T-52; it's under the canopy in the P-51.

Scale maneuvers



BECAUSE I'VE BEEN A CHIEF judge at several scale events, I am often asked which flight maneuvers are best for various aircraft. There is no one "best" maneuver that will work for all types of aircraft so you have to pick whichever maneuvers are best suited to the type of model you're competing with. I think that WW I and civilian light aircraft are handicapped by just doing straight and level flight because of their relatively slow speeds. If you do favor the slower aircraft, I recommend maneuvers such as "the Chandelle" and "the descending 360-degree circle" for maximum flight points.

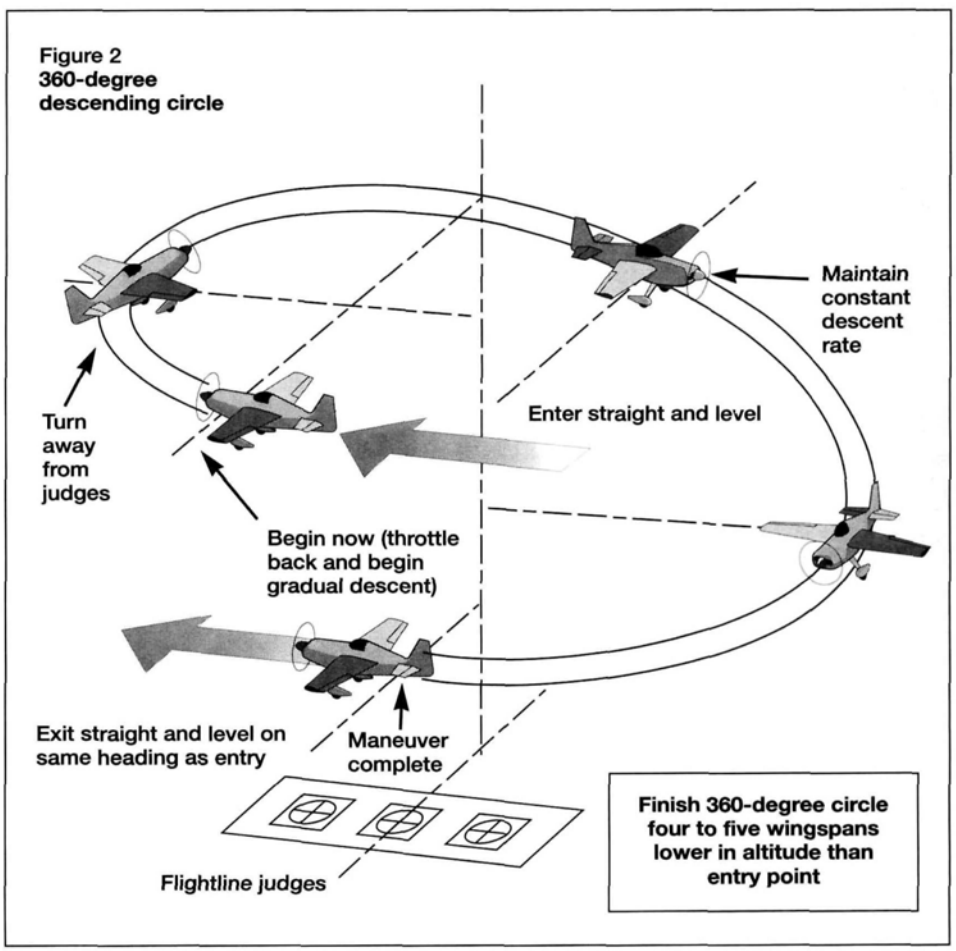
The Chandelle is defined as an abrupt climbing turn in which the momentum of the plane is used to attain a high rate of climb. It is often referred to as a climbing turn. Historians suggest it was used to escape from a dogfight during WW I, so it is a perfect maneuver for this kind of model.

To achieve airspeed and momentum, start the maneuver with a slight dive, then enter straight and level and follow through with a sharp climb while executing a 180-degree turn (away from the judges). Do not stall your model by climbing too steeply, and for maximum points, exit the maneuver in level flight heading in the opposite direction of the entry. I recommend a climb of about four to five times the aircraft's wingspan (about 30 feet for a 72-inch-span model). This should be sufficient to show the judges a prototypical climb for your model; downgrades come from not executing the maneuver smoothly and not exiting 180 degrees from the entry.

The 360-degree descending circle is a gradual spiral descent that exits in the same direction as the entry. The key to making this maneuver work is to have plenty of altitude before you start. If you start too low, you'll have to rush to complete the maneuver, and this will lower your score.

Begin with a level flyby, then, when your model is directly in front of the judges, reduce throttle and start the descent in a large, 360-degree circle (again, away from the judges). When you have completed the full, 360-degree circle and are again on the same heading as when you started, you can increase throttle, level out and call the maneuver complete. Here, as well, the descent should be about four or five wingspans distance.

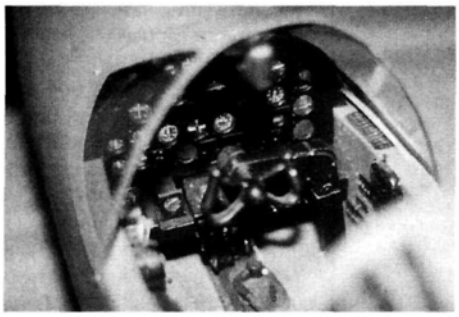
When attempting to maximize your flight scores, remember: for slower flying



models, simple maneuvers are definitely the way to go.

WHAT'S NEW IN THE WORLD OF SCALE?

Brian Burcar, owner of Dynamic Balsa and Hobby Supply* (DBHS), has bought the foam-core-cutting business from Wing Mfg*. DBHS will continue to offer Wing's inventory of popular foam wing and stab cores and will cut special-order cores as well. For the scratch-builder, this is a great resource. Wing Mfg. will continue to supply its Pro kit line as well as its many sport-scale, short kits. Its aircraft accessories and foam-cutting equipment will also still be available.



This is the P-38 Lightning cockpit-interior kit from Dynamic Balsa and Hobby Supply. The company has several cockpit kits available.

DBHS also has some great-looking cockpit-interior kits. These high-quality, vacuum-formed kits are intended for 1/5-scale (and larger) aircraft and include polyurethane resin parts and pieces. Designed for a variety of popular kits including Platt, Ziroli, Vaillancourt and Bates, the interior kits feature formed metal-and-rubber parts that are thoroughly researched for accuracy. Its Ziroli and Bates SBD Dauntless cockpit kits even include the rear gunner's machine gun.

Also from DBHS are lightweight military figures that include 1/4-scale military pilots and 1/8-scale bomber crew figures. These smaller, full-body figures were developed by an artist, and their faces and clothing differ for the various pilots and crew members. I am so impressed with these little guys that I'm actually thinking about starting a big B-17 for my next project; silly me! Give Brian a call for more information.

MEISTER SCALE

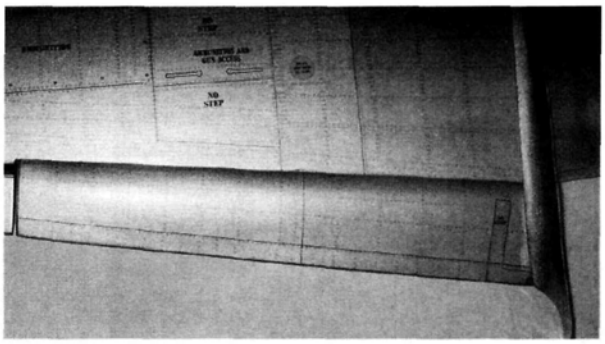
Meister Scale* recently introduced an 84-inch-span Me 109 designed by Ty Brown. Ty's prototype weighs about 18 pounds and is powered by a Quadra 42. Many accessories are available for the Messerschmitt, including an aluminum spinner, formed canopy and retracts. The company also offers a custom-built, framed-up version of the Me-109.

Initial flight tests of Meister's new 120-inch-span Japanese A6M5 Zero showed that the new Zero is very stable. Give Dick Bernier a call; he'll have all the details for you.

SCALE SKINS

A new twist in aircraft covering has presented itself in the form of a product from the Scale Skins Model Co.* As its name implies, the company offers a covering material that has panel lines, rivets and markings already embedded in its surface. The Scale Skins covering can be applied easily to any smoothly finished surface and results in a beautiful scale finish. It eliminates the tedium and drudgery of conventional scale detailing techniques.

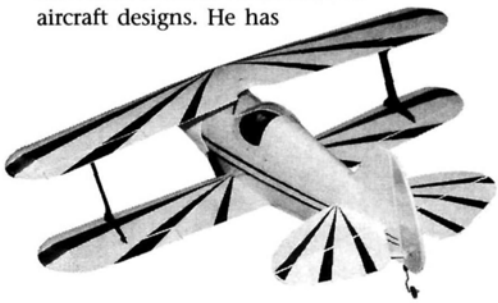
Scale Skins come with an aluminum base color or with a clear base intended to go over a painted surface; they are available for several kits including the Pica P-51 and several Ziroli and Meister designs. Company owner Frank Campbell states that Scale Skins are applied much like a giant vinyl decal; a special application fluid is used to "float" the material into place while minimizing bubbles. The stuff really looks good, and I think it offers the same quality finish as many of the popular ARF warbirds available from Great Planes. And for generic use, Frank offers a variety of hatch, latch and rivet sheets.



Frank Campbell shows off his Scale Skins covering material at the WRAM show. Scale Skins are applied to your model much like a giant vinyl decal; they're available for several WW II fighter kits.

GARY MADDEN BUILDS A PITTS

Gary Madden of Madden Model Products* is well-known for his high-quality kits for the Ziroli and Don Smith line of aircraft designs. He has recently designed and kitted a nice little 39-inch-span S1S Pitts Special bipe. The Pitts uses an O.S. .52 4-stroke or .46 2-stroke engine for power, and Gary told me its finished weight is around 5 pounds; the assembled aircraft can fit in the back seat of a small car. The kit contains everything necessary to finish the plane.



I was very impressed with the new, 84-inch-span Me-109 from Meister Scale. Here I am with designer Ty Brown's prototype; many accessories are available.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

Send in your event coverage. Mail photos, captions and text (500 words or less) to "Grassroots," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Color slides and prints are acceptable.

JR Gold Cup Series Race, Phoenix, AZ

A Quarter Midget pylon race is kinda crazy. We start up the engines, and in no time, they're zinging their 7-inch propellers at 26,000rpm. These engines have only two speeds: on and off. When they're on, these .40s are putting out over 4hp. The mostly composite Quarter Midget planes are pretty small; 56-inch span is the norm, and each design is kept to the minimum allowed by the rules.

In about 2 minutes, it will all be over. That doesn't sound like a long time, but if you could feel the way my heart pounds when we fire these things up, you'd know that I probably couldn't take much more. Oddly enough, the guys surrounding me aren't all 20-somethings. No, it takes as much strategy and discipline to win as it does eye/hand coordination and superb reaction skills. Pylon racing is a blend of golf and drag racing, if you will.

Take the start, for example: you have 60 seconds to start your engine; at take-off minus 5 seconds, everyone is usually in place—pilots have given their callers and the starting flagman the nod that all the controls are working and they're ready to race. Lap counters and pylon flagmen are tucked away in steel cages for protection, watching intently as the fun is about to begin. When the flag drops, the racers will accelerate to 90mph and reach pylon 1, which is 500 feet away, in just 4 seconds. Callers

The victors! Standing (left to right): Scot McAfee, Darrol Cady with his wife and caller, Rhonda, Chip Hyde and Rusty Van Buren. Kneeling (left to right): Lee Vonderhay, Gary Schmidt, Dave Shadel, Bob Dible and Matt Van Buren.

Racers line up for practice times.

Race organizer Jim Allen identifies Gary Schmidt's Miss Ashley. That Nelson .40 hanging out in the breeze stays cool while putting out massive horsepower. The best part of Quarter Midget racing is that you don't have to be an engine wizard to be competitive; engines sold by Nelson and Jett are ready to run!

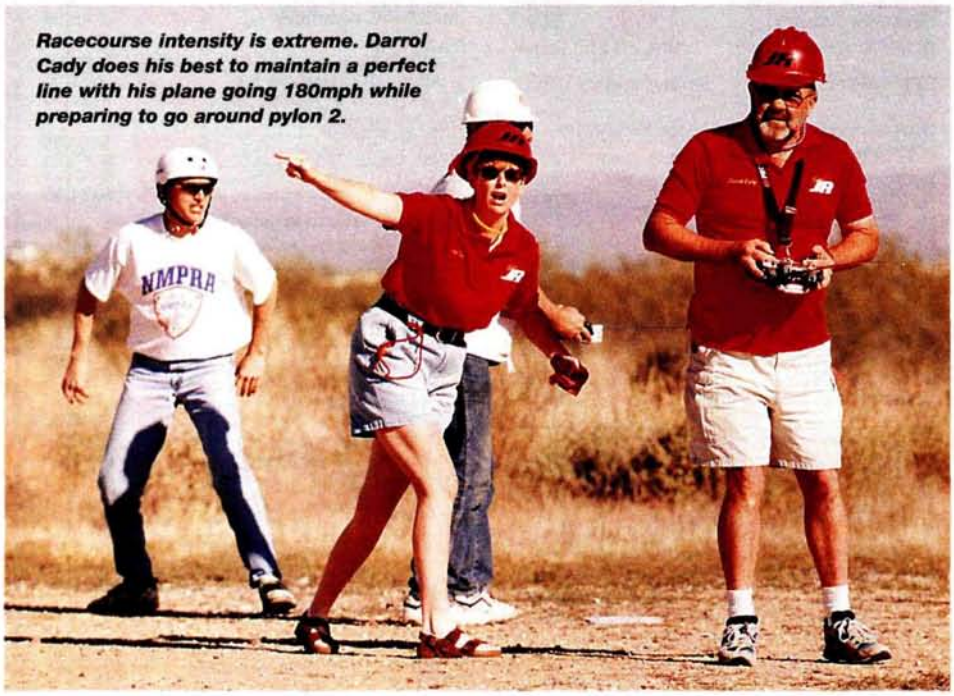
One second to blast-off! The start can make a big difference. Note how Chip Hyde (second from left) is nearly prone to add stability and thrust to his launch of Tony Lopez's airplane.

scream, "Turn!," and the planes whip around in violent, 180-degree turns. In just 4 more seconds, the planes will have accelerated up to 180mph and reached pylon 2, which is 600 feet away.

Traveling in formation, the four planes are heading for the same spot: the racing line. There's only one fast way around the track, so if you want to be competitive, your plane won't be much more than 10 feet outside pylon 2; that's not easy at 180mph, but you learn.

With the right amount of elevator around pylon 2, you'll be at pylon 3 in no time. Go around pylon 3, and you've just completed your first lap; only nine more laps to go. Now the real racing begins. As it proceeds, your caller keeps you apprised of your position and your competitors' cuts, all the while calling the number 1 turn precisely every 6 seconds.

Racing is a game of crossing the finish line first, of course. But races are comprised of heats, and points determine the overall winner. Many a race has been won by a racer who is willing to take a second in a heat, rather than push too hard to win; strategy is crucial.



Racecourse intensity is extreme. Darrol Cady does his best to maintain a perfect line with his plane going 180mph while preparing to go around pylon 2.

THE ACTION IN PHOENIX

Fifty-six gladiators arrived with their planes to duke it out at the SpeedWorld R/C fliers' facility in Phoenix, AZ. The day was filled with tight competition. There was only a 4-second difference between the heat times of the first and 18th fliers. Most of the races were decided by less than 2 seconds. Pilot Chip Hyde took home first-place honors after an exciting fly-off with Darrol Cady and Rusty Van Buren.

What made Phoenix special? Undoubtedly, it was the SpeedWorld R/C Fliers. Club president Bill Starr, contest director Hal Grier and about 20 stalwart fellows put on a great race. In the contestants' eyes, these fellows are the real winners.

Are you interested in racing Quarter Midget? Contact the National Miniature Pylon Racing Association, America's oldest special-interest group dedicated solely to racing. Call Barry Leavengood at (818) 994-4364, and he'll fill you in on people in your area who are active in racing.

JR GOLD CUP SERIES SPONSORS

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PRODUCT NEWS

Latest product releases

INFORM YOUR CUSTOMERS! **Model Airplane News is interested in showing our readers your new products—here in Product News. If you'd like to see your *products here, send us clear photos and a press release that provides information* about them! We'll publish as many as space permits.**

Send your announcements to: Product News, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

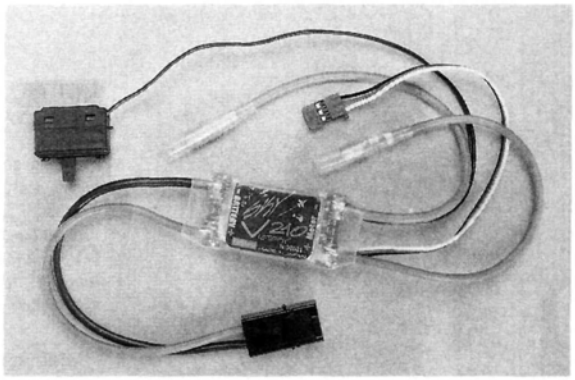
SIG MFG. CO.

Somethin' Extra

Sig's new fun-fly design features great looks, ease of assembly and CNC laser-cut wood. Virtually all of the hardware needed to complete the model is in the kit, including the wheel pants and landing gear. Specifications: wingspan—51.5 inches; wing area—614 square inches; flying weight—4¼ to 5 pounds; recommended engine—.25 to .32 2-stroke.

Price—$89.95.

Sig Mfg. Co., P.O. Box 520, Montezuma, IA 50171; (800) 247-5008; (515) 623-5154; fax (515) 623-3922; website: www.sigmfg.com.



KYOSHO

Aircraft Speed Control

With its high-frequency operation and compact size, the Sky Victory 210 is ideal for all types of electric aircraft that don't require a brake circuit. This powerful unit features "receiver voltage priority"; this directs current to an airplane's controls if voltage falls too low. Specifications: volts—7.2 to 9.6; continuous current—4 minutes @ 50 amps; weight—1.6 ounces; FET on-resistance—0.0018W; length—1.9 inches; width—1 inch; height—0.5 inches.

Part no.—KYOA2520; **price**—$139.99.

Kyosho/Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-1104; website: www.hobbies.net/kyosho.

SULLIVAN PRODUCTS

Bare Propeller Starter Insert

This new steel-reinforced, neoprene propeller insert turns your propeller with its "cam-out" design. It will fit most 2-blade propellers up to 15 inches in diameter.

Part no.—S635.

Sullivan Products, P.O. Box 5166, Baltimore, MD 21224; (410) 732-3500; fax (410) 327-7443.

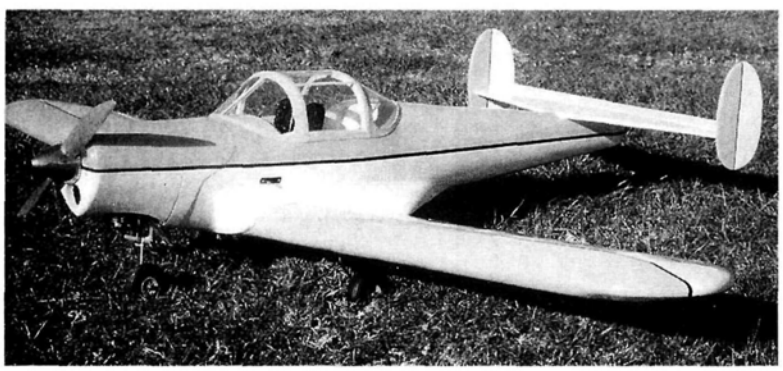
AUTOGYRO CO. OF ARIZONA

2-D Autogyro

This R/C autogyro rises off the ground like a feather, is capable of loops and rolls, and it lands on a dime. The 2-D is a silhouette scale (profile) of the 1935 Pitcairn PA-22. The 2-D features laser-cut parts (including the preshaped rotor blades), rotor bearing, formed landing gear, motor mount and detailed, 40-page construction and flying manual. The 2-D Deluxe adds a fuel tank, wheels and the necessary hardware to complete the model.

Prices—$129 (standard); $169 (deluxe); $15 (flight video).

Autogyro Co. of Arizona, 3307 West Renee Dr., Phoenix, AZ 85027; website: www.autogyro-rc.com.



REID'S QUALITY MODEL PRODUCTS

1/5-scale Ercoupe Plans

These rolled plans are perfect for the person who has built a few model kits and is looking for a stable, easy-to-fly scale airplane. The Ercoupe has all-wood construction and features a one-piece wing with twin functioning rudders. Specifications: wingspan—72 inches; wing area—870 square inches; weight—11 to 12 pounds; power required—1.2 to 1.5 2-cycle.

Prices—$24.95; $31.95 (fiberglass cowl), plus S&H.

Reid's Quality Model Products, 30 Clifton St., Phelps, NY 14532; (315) 548-3779; website: www.reidsmodels.com.

MODEL DESIGNS BY BALSACRAFT

Electric or Glow Sport Focke-Wulf

Here's a sport-scale warbird sized to fly at smaller fields with electric or glow power. The Focke-Wulf features die- and laser-cut components, plastic-formed parts, extensive decals and even a pilot figure. Specifications: wingspan—48 inches; wing area—386 square inches; weight—48 ounces; wing loading—18 ounces per square foot; radio required—3- to 4-channel.

Part no.—BLCA0104; **price**—$129.99.

Balsacraft/Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008.

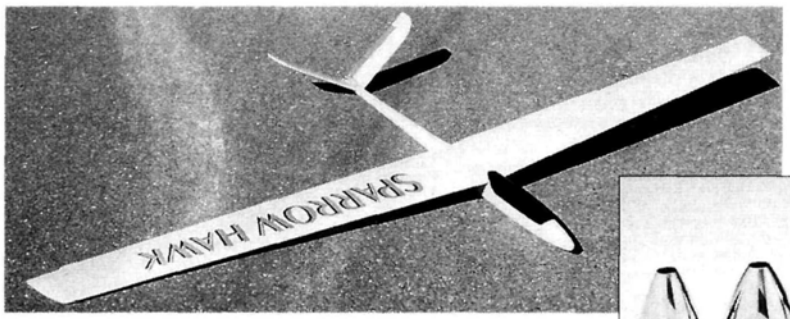
OLD RHINEBECK AERODROME

Return to Rhinebeck

Journey to the world-famous Old Rhinebeck Aerodrome. See beautifully restored antique aircraft take to the skies and get a behind-the-scenes look at the incredible collection that Cole Palen spent a lifetime amassing. Stunning full-color photographs fill this 161-page, hardbound book.

Price—$35 (plus S&H).

Old Rhinebeck Aerodrome, 44 Stone Church Rd., Rhinebeck, NY 12572; (914) 758-8610.



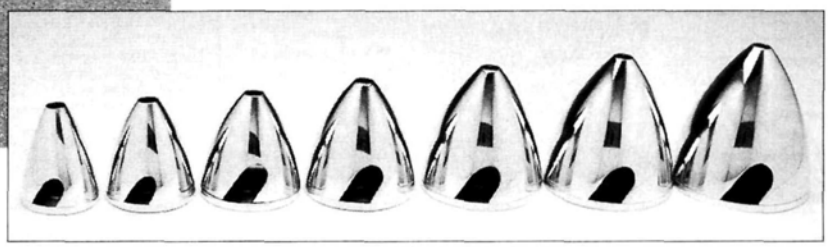
NORTHEAST SAILPLANE PRODUCTS

2-meter SparrowHawk C

The SparrowHawk C (for "composite") was created for the modeler who enjoys cruising or flying on the big slopes. The all-carbon-fiber wing is a 2-piece design with internal reinforcement to support twice the normal flying weight. For ease of transportation, the tail is also removable. Specifications: wingspan—80 inches; wing area—540 square inches; weight—34 to 50 ounces; wing loading—9 to 14 ounces per square foot.

Prices—$299.95; $319.95 (with flaps and ailerons).

Northeast Sailplane Products, 16 Kirby Ln., Williston, VT 05495; (802) 658-9482; website: http://www.nesail.com.



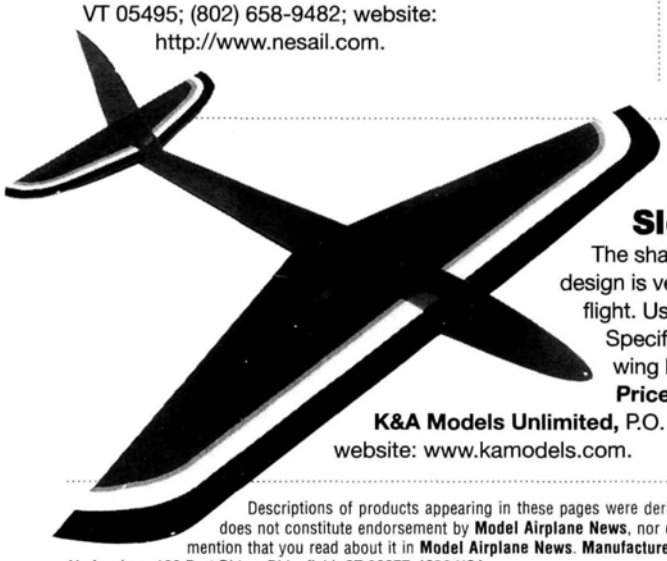
Great Planes Model Distributors

Polished Spinners

Add the unmistakable style and beauty of a polished aluminum spinner to your next airplane. Great Planes now offers seven different sizes, from 1½ to 3 inches, in ¼-inch increments. Each spinner features a bolt-on design that centers it on the backing plate for vibration-free rotation. Bushings and hardware are included in each package, and adapters for O.S. and SuperTigre engines are also available.

Part nos.—GPMQ4550 through GPMQ4556; **prices**—$14.99 to $29.99.

Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; website: www.greatplanes.com.



K&A MODELS UNLIMITED

Mini-1 XL Slope Glider

The sharp, clean lines of the all-new Mini-1 XL say it all. This balsa, ply and foam wing design is very fast on the slopes and has great energy retention throughout turns and aerobatic flight. Using the RG14 airfoil, the Mini-1 XL is comfortable to fly upright or inverted. Specifications: wingspan—31 inches; wing area—178.25 square inches; wing loading—9 to 10 ounces per square foot; weight—10 to 11 ounces.

Price—$69.99 (plus $7.99 S&H).

K&A Models Unlimited, P.O. Box 66527, Albuquerque, NM 87193-6527; (505) 836-3681; website: www.kamodels.com.

by Don Edberg

More on using mixers

A LOT OF PEOPLE CONSIDER computer radios as a first radio or as a replacement. One of the neatest things found in most of them is the programmable mixer. It has been a while since I've talked about mixers, so I'll look at them again from a beginner's viewpoint.

Programmable mixers may be used to make automatic corrections or compensations for control movements. A mixer can be used to automatically apply a bit of elevator when the flaps are dropped to account for changes in trim, or to apply corrective aileron during knife-edge flight to correct for an undesired rolling tendency.

Before we begin to look at mixing, let's go over a few definitions. Remember, we're considering a situation in which one control's motion affects not only its own servo, but another servo as well. The control is known as the "master" because it dictates the motion of another servo known as the "slave." Notice that the slave servo is *not* plugged into the master channel's output. So, for the example of elevator compensation for flap movement, the master channel would be Flaps, while the slave channel would be Elevator.

Let's take a detailed look at how the master control affects the slave channel. We'll pretend that our radio provides full servo travel on the slave channel when we give full motion of the master control, and it has a value of 100 percent mixing programmed.

Figure 1 shows what happens when we mix from a centering stick to a slave servo. Column A shows the movement of the master control. The master channel can be any centering control, such as aileron, elevator and rudder. The slave servo may be plugged into any channel that you want to mix to. For the knife-edge example, the master is rudder stick, and the slave is the elevator servo. The slave can also be an auxiliary channel if desired. Column B shows the response of the servo that's plugged into the slave channel (with 100 percent mixing turned on). Please understand that the actual travel amount and direction will depend on the make and model of radio used; the figures show a "typical" setup and will be consistent for a given system.

You can see that when the master control is centered (the row marked "3: No stick motion"), the slave servo remains centered. When the master is moved one way (rows 1 and 2) or the other direction (rows 4 and 5), the slave channel follows it proportionally. Full stick motion provides 45 degrees of slave servo motion, and less stick motion provides proportionately less than 45 degrees of slave motion.

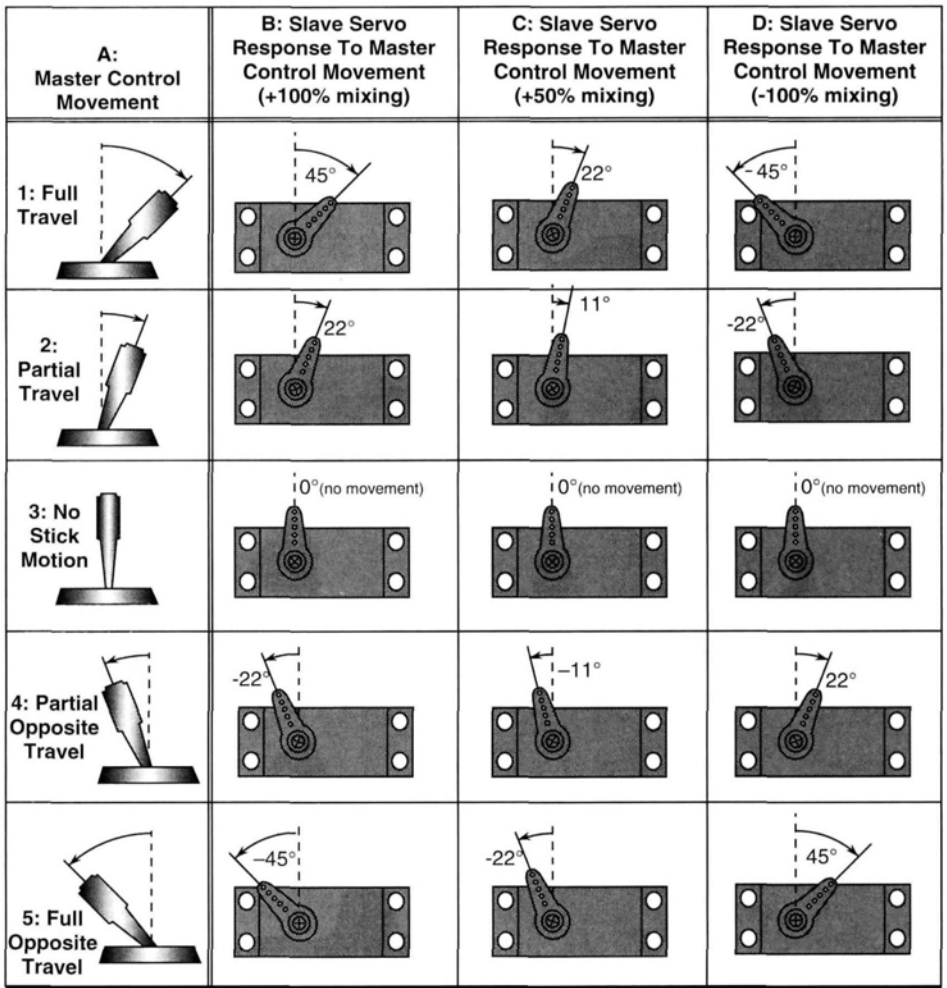


Figure 1. Here's how a mixer commands a slave servo to respond to a centering master channel such as aileron, elevator, or rudder.

A point to make here is that Figure 1 *shows only the motion of the slave servo that's controlled by the master control.* If the control corresponding to the slave servo is moved, the slave servo will respond to *both* of these inputs. The total slave servo response is the motion commanded by the slave's control *plus* the motion from the master control coming through the programmable mixer. You can see that there may be problems if you ask for a large mixing value plus large slave control motion: the sum of these could cause the servo to hit a stop or bind up a control because of *too much* commanded travel.

So let's reduce the slave's response. The easiest way to do this is to reduce the master channel's mixing amount. The result is proportional to the amount of mixing percentage selected. If we wanted to reduce the slave's response to half of what it was in column B, we'd select a mixing ratio of 50 percent. The result of programming in this reduced value of mixing is shown in column C. Note that the servo now responds half as much as it did in column B.

What if the slave servo responds in the opposite direction from the one you want? You might think you could reverse the slave servo, and this would cause it to move in the opposite direction from the master control; however, it would also *reverse the response for the slave's control!* If you were trying to solve the knife-edge problem, you'd have reversed the elevator

servo, and you can imagine the results of doing that!

The correct way to reverse the slave's response to the master control without affecting its response to its own channel is to reverse the mixing percentage. So, if we had 100 percent mixing, we would change it to –100. In column D, you can see that the slave servo responds in the opposite direction of the master control. Also note that if you happened to have the mixing percentage as a negative number, you would change it to a positive number.

Figure 2 is a graph of +100, +50 and –100 percent mixing values. Cutting the ratio from 100 to 50 percent changes the *slope* of the mixing line, and calling up –100 percent produces its mirror image.

All this explains what happens when you have a master control that centers, such as aileron, elevator, or rudder stick. If you have a non-centering channel, like a throttle stick, sliders or knobs that turn, offset the mixing line so that the mixing starts at one end or the other of the control. In Figure 3, we've offset the mixing position to start at idle, so the slave servo doesn't move when the throttle is at idle. As we increase the throttle-stick command, the slave servo turns more and more clockwise until we reach full throttle, where we get maximum slave servo response. Again, remember that Figure 3 only shows the slave's response to the master control; the slave's control will also command slave response.

You can see the effect of offsetting the mixing line graphically in Figure 4. The offset mixing line ensures that the slave servo doesn't move at one end of the throttle-stick motion. As you might expect, this is good for a model that needs a trim change at power levels above idle but doesn't need any trim at idle or power off.

Another point about programmable mixers: you can usually set the mixing percentages on each side of the zero point. For example, in Figure 2, you could have 100 percent on one side of the master's neutral position and a different percentage on the other. If you don't know this and set only one side, you'll see the mixing essentially disappear on the other side of the master's motion! Be sure to set both sides!

You can also set up your transmitter so that you can switch mixers on and off or have them always on. Your choice will be obvious when you set things up.

I hope that these descriptions have given you an idea how mixers may also be used to custom program for special functions that are not contained in built-in menus. Next, we'll see an example of using a programmable mixer to turn a smoke system on and off.

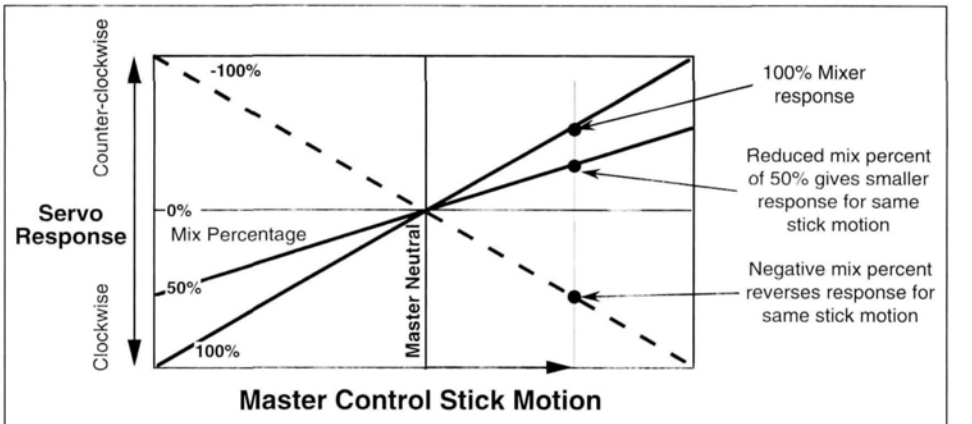


Figure 2. The contents of Figure 1 shown graphically. You can immediately see the changes that occur by reducing the mixing percentage and changing its sign.

SMOKE SETUP EXAMPLE

Many folks have asked me how to set up their computer radios' programmable mixers to operate smoke systems. A smoke system is usually turned on by one of two methods:

1. The smoke system goes on when a microswitch closes. The microswitch is usually mounted on top of or near a servo. The switch is closed after the servo travels some amount of throw.
2. The smoke system is electronically controlled and plugged directly into the receiver (like a servo or electronic speed control). The smoke system comes on whenever the transmitter commands enough "servo travel" to be activated.

The easiest way to get smoke is to plug either the servo with the microswitch or the smoke switch itself into a receiver channel that's controlled by a toggle switch (such as the retract channel). In this simple case, when you want smoke to come on, you just flip the smoke switch. This will turn the smoke on regardless of the power setting. Because you usually don't want the smoke on unless the engine is running at a higher power level (usually associated with passing a preset throttle-stick position), let's figure out a way to get this to happen.

We want to program the transmitter to tell the smoke system to work in the manner shown in Table 1. You can see that the smoke turns on only *when the throttle is above a certain level* ***and*** *the smoke switch is on.* If the throttle is below the desired power level or the smoke switch is off, then there is no smoke.

Table 1. Desired Smoke System Operation

THROTTLE POSITION	SMOKE SWITCH	SMOKE SYSTEM
Below preset position	Off	Off
Below preset position	On	Off
Above preset position	Off	Off
Above preset position	On	On

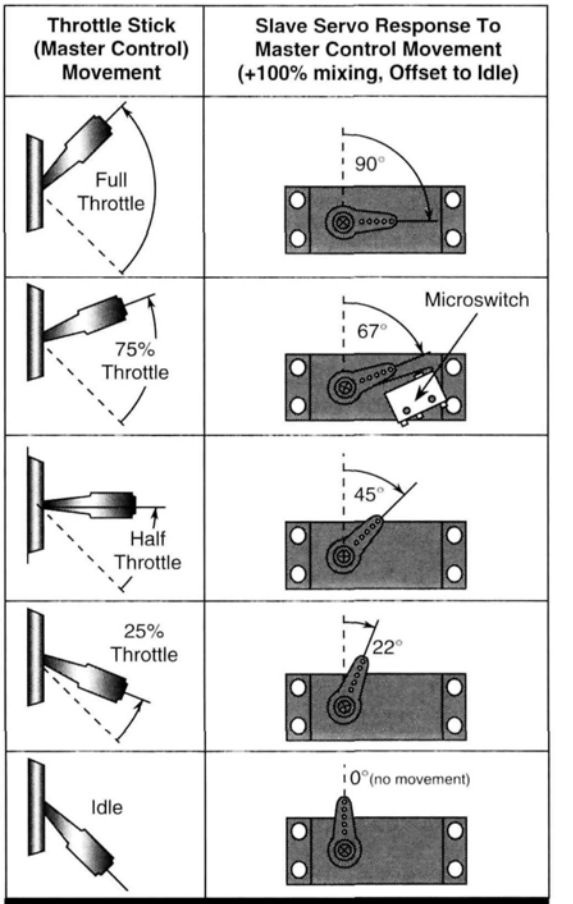
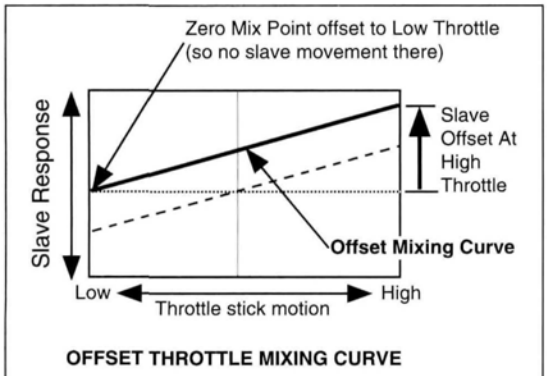


Figure 3. For a non-centering control, such as throttle or a knob or slide lever, the mixer can usually be offset to start working from one end of the master control rather than the middle, as shown in Figures 1 and 2.

We can set up a programmable mixer to make sure that the operation of the smoke system matches the table. We'll look at a microswitch-driven system in this example, but the procedures will apply to an electronic smoke system as well.

1. We'll assume that the smoke system will be controlled by throttle position and the mixer on/off toggle switch. You'll need a free programmable mixer to accomplish this. When it's turned on, the mixer will command the servo to move to the on/microswitch position *only if* the throttle is above your desired smoke-on position.
2. The servo that operates the smoke system should be plugged into a spare channel output from the receiver.
3. Select an available programmable mixer and activate it. Choose the master channel to be throttle and the slave channel to be the channel number on your receiver's spare output. Move the mixing offset position to be the low throttle position (see Figure 4) so that you get the most mixing travel at high throttle. Select a trial mixing percentage of 100 percent (you can leave the low side percentage at 0 because the smoke will only be on at the high side).
4. Move the throttle stick back and forth so that you can choose its + or – sign. When this mixer is on and the throttle is advanced, the slave servo should move in the direction needed to close the smoke switch. Also, position the mixer's on/off switch and verify that when it's off, the slave servo does not respond to throttle-stick position.
5. Position the smoke-system microswitch so that it will only operate the smoke system when the slave servo arm passes a location corresponding to the desired power level.
6. With the smoke switch on (remember, that's the mixer's on/off switch), move the throttle stick to the position where you want the smoke to turn on, and increase or decrease the mixing-rate percentage as necessary to get it to barely turn on (see Figure 5).
7. Vary the mix rate percentage, which changes the slope of the mixing curve, sweeping the smoke-on position back and forth. Note that a higher mix rate (steeper slope) as shown by M1 in Figure 5, turns the smoke on earlier than a lower mix rate (shallower slope) as shown by M3. M2 indicates a mix percentage between M1 and M3. By slowly changing the percentage of the mixing curve, you can adjust the smoke-on power level to be exactly where you'd like it; just be sure to keep the throttle stick in the desired position.
8. Verify that when full throttle is commanded, the microswitch's arm has enough flexibility and won't stall the smoke servo. If it doesn't, or if you hear a buzzing, relocate the microswitch to get rid of the buzzing while still turning on at the right position.



OFFSET THROTTLE MIXING CURVE

Figure 4. Here is how we graphically show the offset of the mixing curve. It has no effect on one end of the master channel and maximum effect at the other end. Compare with Figure 3.

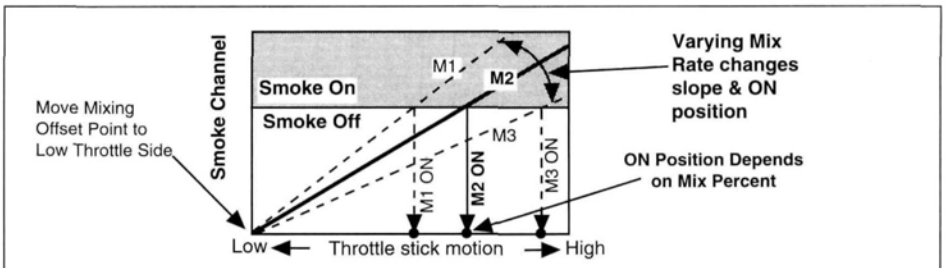


Figure 5. For the smoke system on/off control, you can vary the "on" throttle position (the place where the ascending line passes into the gray "on" area) by changing the mixing percent value. Note the intermediate mixer rate M2 is lower than M1 but higher than M3. Be sure to offset the mixing point to the low throttle position to get the maximum effect.

Figure 3 shows a smoke microswitch being turned on at the 75-percent throttle position: the servo arm has just pushed the microswitch far enough to close the switch and turn on the smoke system. By changing the mixing percentage, you change the place where the smoke microswitch is turned on.

Notice that you must set things up carefully so that when full throttle is commanded, the slave servo arm won't jam on the microswitch and cause the servo to stall (see Figure 6). Instead, be sure that the microswitch is far enough away that its metal tab will bend instead of stalling the servo.

If the smoke system won't turn on at any percentage and the servo is moving in the proper direction, you may need to reposition the microswitch closer to the servo arm. Alternatively, you can try adding a second free mixer that does exactly the same thing; the effects of the two mixers add up and give more slave servo travel.

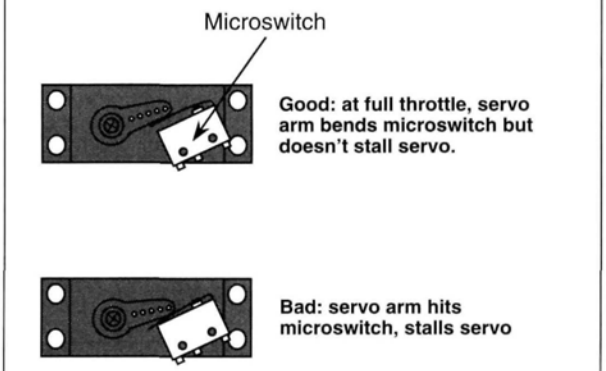


Figure 6. Set up your smoke system's microswitch so that even at full throttle, the slave servo arm doesn't bind on the microswitch and stall the servo. If it does, remount the microswitch and reset the mix percentage.

OTHER OPTIONS

There are many other ways to set up a mixer for smoke systems. For example, the Airtronics* Stylus, Futaba* 8U and 9Z and other radios allow you to define a stick switch that automatically turns on a mixer. You define the stick switch to be turned on when the throttle stick passes a certain power level. That's it!

You can use these procedures for an onboard glow system as well. Because you want this to operate near idle, you set it up in the opposite way: the throttle stick turns the glow system *off* when the throttle is above a set amount of travel (say, 5 percent stick), even when the master switch is on. After you land and before you turn the model off, you'll want to turn off this mixer so that you don't kill your glow-system battery.

Remember, if you want to write to me, send your self-addressed, stamped envelope to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877 USA, or email me c/o man@airage.com. I get lots of mail, so please be patient!

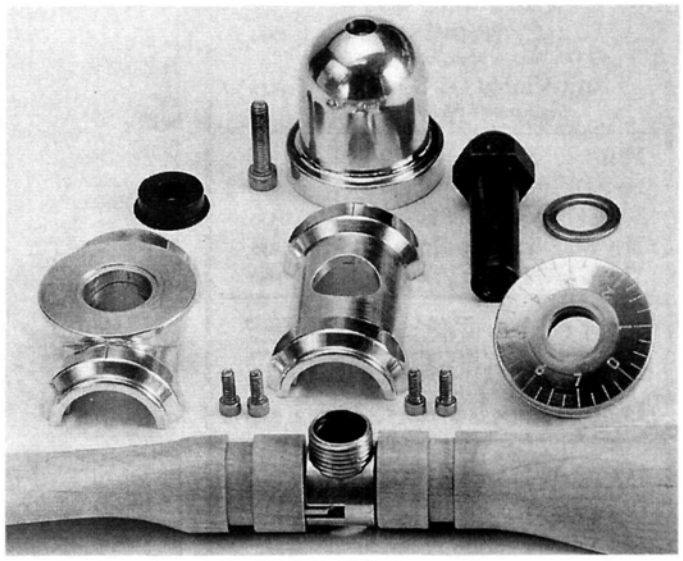
**Addresses are listed alphabetically in the Index of Manufacturers on page 150.*

by Dave Gierke

Moki Vari-Pitch Propeller

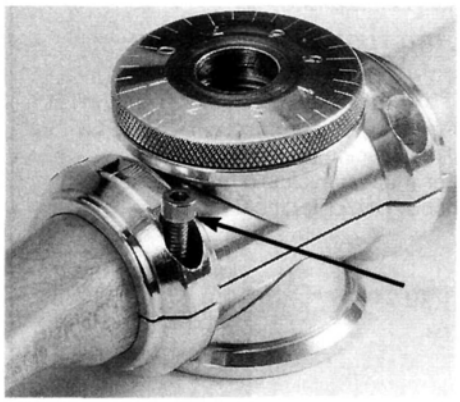
Gerard Enterprises* has long been an importer of fine, high-quality components for the model aviation community. Jim Gerard's latest entry is the Moki Vari-Pitch Propeller, a unique and beautiful product from the Canadian firm NRG Research, Ltd.

Variable-pitch propellers have come and gone from the modeling scene for many decades. Designed as either ground adjustable or in-flight actuated, most have proven to be inadequate in one respect or another. Hi Johnson's (Dynamic Models Inc.) Auto Pitch propeller from the early 1960s offered a solution for engines that wouldn't throttle down adequately: "The Auto Pitch propeller will eliminate ... the unstable running conditions encountered by modelers attempting to 'carbureate' [throttle] at rpm lower than a 2-cycle glow or diesel is capable of attaining." He continued, "... the propeller will remain at a predetermined low rpm pitch setting until the engine rpm reaches approximately 6,000, where it automatically starts to change to a higher pitch. At approximately 7,000rpm, the blade will reach the full predetermined pitch." To vary the high- and low-pitch settings, a number (up to 12) of thin shims had to be installed into the hub (as I recall, quite a bit of experimentation was required to get the system working correctly). In fact, Hal "Pappy" deBolt had one memorable flight: as he throttled back on his landing approach, the model suddenly lost flying speed and fell to the ground like a shovelful of mortar—a funny sight to everyone but Hal! A postmortem revealed that the prop had de-pitched to a negative setting, thus acting like an airbrake. Thank goodness for effective throttles!

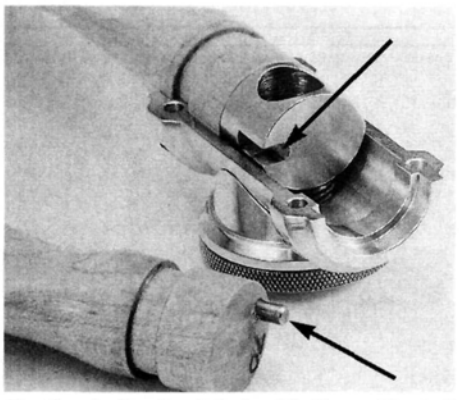


PHOTOS BY DAVE GIERKE

Another view of the Moki Vari-Pitch propeller components.



With the assembly resting on the rear hub, the calibrated dial is facing upward. Note that the hub safety screw is about to be tightened (arrow).

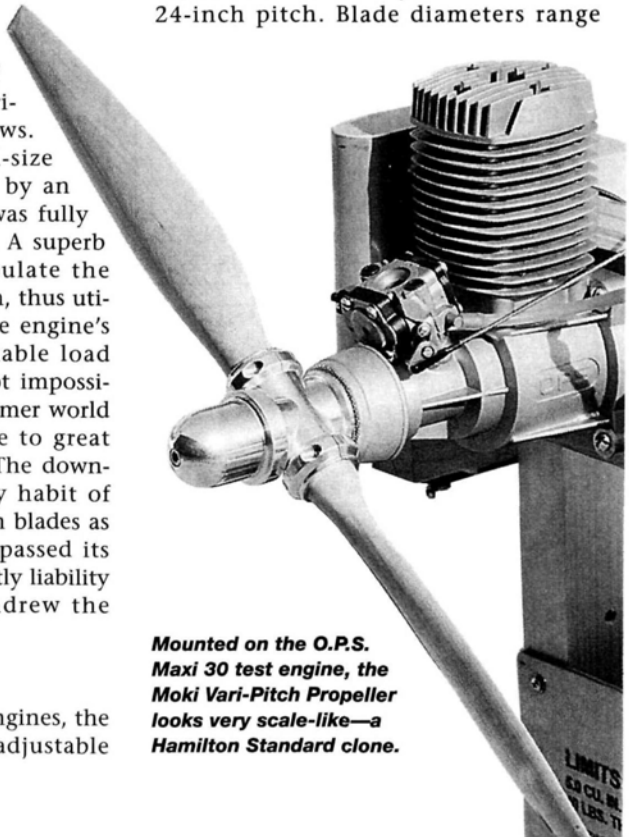


Resting in the front hub with the calibrated dial attached, the actuator awaits the second prop blade. Notice the steel pin in the prop and the slot in the actuator (arrows).

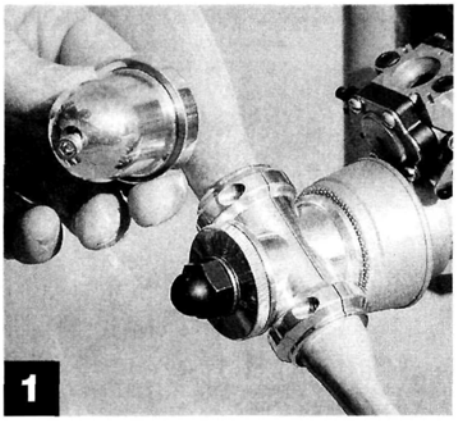
Another in-air actuated variable-pitch propeller was introduced in the early 1980s. Intended primarily for pattern fliers, Kato Model Aircraft Co. Ltd. of Osaka, Japan, released its variable-pitch prop to rave reviews. Operating similarly to a full-size unit, it was servo-controlled by an auxiliary radio channel and was fully proportional in its operation. A superb pilot could not only manipulate the throttle but also propeller pitch, thus utilizing the full potential of the engine's horsepower throughout variable load maneuvers—a difficult, but not impossible, task. Hanno Prettner, a former world champion, used one of these to great advantage for a brief period. The downfall of the Kato was its nasty habit of shedding fiber-reinforced nylon blades as engine horsepower levels surpassed its mechanical limits. To avoid costly liability suits, Kato reluctantly withdrew the product from the marketplace.

A CLOSER LOOK

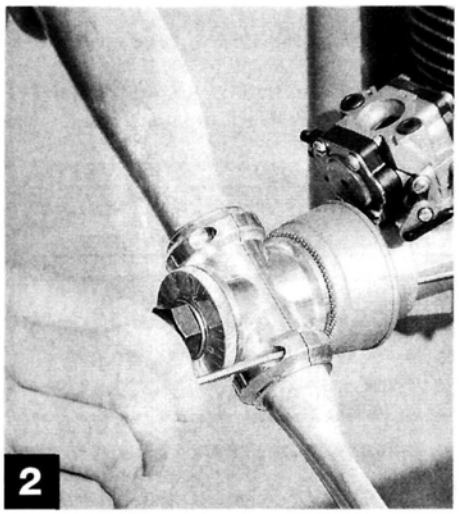
Designed for 1.2ci and larger engines, the Moki Vari-Pitch Propeller is adjustable only on the ground, making it structurally robust, but obviously less versatile than in-air adjustable designs—none of which are currently available for combustion engines. Besides its beauty (the 2- and 3-blade versions remind me of full-size Hamilton Standard propellers from the '30s and '40s), the materials and workmanship are of the highest order. The hubs are made in 2-, 3- and 4-blade models, all of which are adjustable from 4- to 24-inch pitch. Blade diameters range



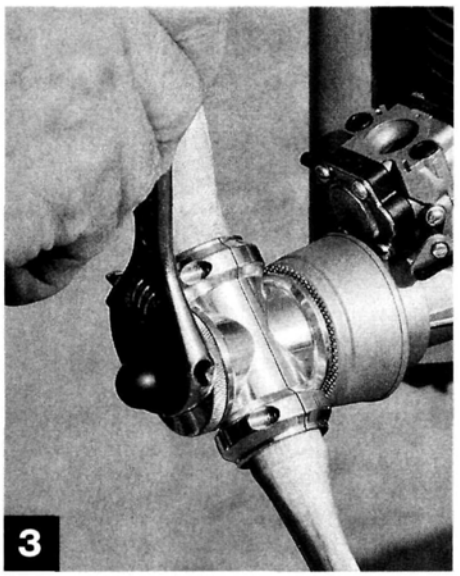
Mounted on the O.P.S. Maxi 30 test engine, the Moki Vari-Pitch Propeller looks very scale-like—a Hamilton Standard clone.



To change pitch, first loosen the spinner attachment screw and remove the spinner.



Using the Allen wrench (provided), loosen the four hub safety screws.

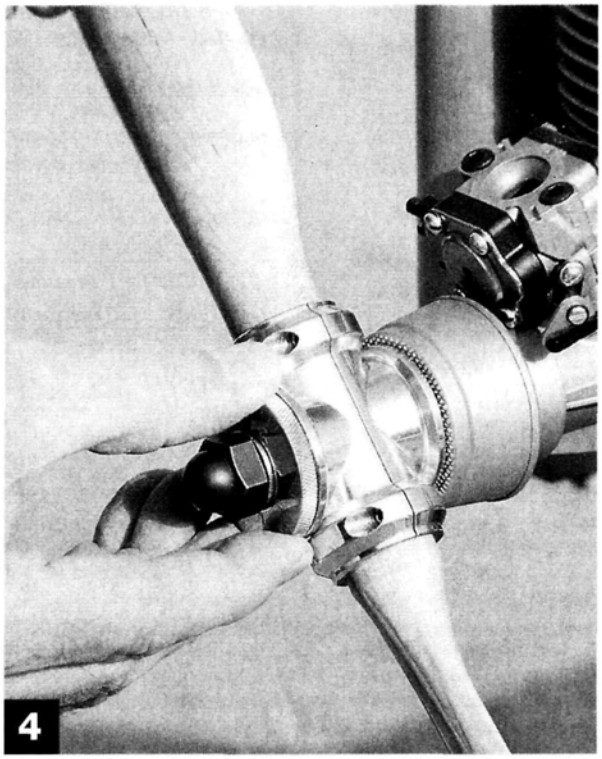


Using an open-end wrench, loosen the extension nut that secures the assembly to the engine shaft.

between 18 and 30 inches. Front and rear hubs are CNC-machined out of bar-stock aluminum alloy to close tolerances and are polished to a fine luster. The blades are made of high-quality maple and are finished with durable polyurethane (gloss). They are packaged in balanced, matched sets of two.

The components include

- Hub assembly (front and rear hub, actuator, calibrated dial).
- Blades.
- Extension nut.
- Rear hub bushing.
- Extension stud (only used with engines that have a removable prop screw).
- Spinner (optional).



To adjust the propeller to the desired pitch, first turn the calibrated dial counterclockwise to the "home" or zero-pitch position. Next, turn the calibrated dial clockwise eight digits. The 20-inch prop will now have an 8-inch pitch. Pitch/calibration digits for all blade diameters are easily obtained from a handy chart included with the unit. Finally, re-torque the adjustment nut and retighten the hub safety screws and replace the spinner; you're ready for another flight.

The hub assembly represents the primary portion of the initial investment. If you own the hub, you can freely substitute blade lengths and styles. By buying additional extension nuts, bushings and the occasional extension stud, the hub will work with a great variety of engines. Gerard provides a convenient listing of all necessary hardware for the engine of your choice.

ON THE BENCH

I tested the Moki Vari-Pitch Propeller on my O.P.S.* Maxi 30 (1.8ci) 2-stroke engine. The 20-inch-diameter, 2-blade unit was simple to set up using the suggested no. 8025 extension nut and no. 0008 bushing. The extension stud wasn't needed because the crankshaft has its own nose threads. As shown in the photo sequence (1 through 4), pitch was easily accomplished by rotating a calibrated dial in conjunction with pitch specifications from a printed chart—a straightforward procedure.

When the Vari-Pitch Propeller was adjusted to an 8-inch pitch, the engine turned 7,100rpm. When adjusted to a 10-inch pitch, the result was 6,200rpm. This agrees closely with what I previously attained with APC* 20-inch-diameter propellers. The APC 20x8 turned 7,200rpm, while the 20x10 turned 6,500rpm. Because the Moki Propeller has considerably more blade area than the APC, I wasn't surprised that it loaded the engine slightly more at each pitch setting.

I was pleasantly surprised that the assembled propeller was perfectly balanced, with tip runout measured at less than 0.040 inch. This is better than most fixed-pitch wooden propellers found on the market today—very impressive.

Unique to propeller manufacturers/distributors, Gerard specifies extension nut torque numbers for its product. So, if you don't have a pound/foot or pound/inch (preferred) torque wrench, you should probably get one. Reviewing the specifications sheet, I found that recommended torque ranged between 12 lb./ft. (144 lb./in.) and 16 lb./ft. (192 lb./in.) for a great many engines.

Complete unit prices range from approximately $190 for the 2-blade, 18-inch unit with spinner to about $350 for the 4-blade, 30-inch assembly including spinner. Of course, there are many intermediate sizes and prices, but one thing is for sure: if you can't find what you're looking for with the Moki Vari-Pitch Propeller system, you're not really trying!

**Addresses are listed in the Index of Manufacturers on page 150.* ✚

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THUNDER TIGER ARFs and engines for sale: Tiger Trainer .40, $83.50; Tiger Trainer .40 Combo, includes airplane, engine and 4-channel Hitec radio, $274.99; Tiger Sport 40 L, $106.99; Tiger Stick 40, $92.99; Champion 45L, $120.99; Fun Tiger Extra or Giles G-200, $92.99; Windstar 2M Glider, $69.99; Windstar with Hitec 1-stick, 2- channel *radio*, $129.99; *Windstar 2 M Electric Glider*, $102.99, with radio $148.99; Raptor .30-size Heli, Pro Model, $414.99; Raptor Regular, $379.99, Raptor kit ,$249.99; TT Pro Heli .36H, $92.75; GP .42, $48.99, Pro .40, $69.99, .46 $69.99, Pro .61 $107.99, FS .54 $145.99, FS .91 $160.99. GCBM R/C MODELS, 5009 Fairdale, Pasadena, TX 77505. Information: (281) 998-2529; orders only, (800) 609-7951. Visa/MC/checks OK. [6/00]

HOBBYIST

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MODEL AIRPLANE NEWS, 1930-1980; "Air Trails," 1935-1952, "Young Men," 1952-1956; "American Modeler," 1957-1967; "American Aircraft Modeler," 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, B.C. Canada VOR 101. [10/99]

WANTED: built or partially built scale Cessna 150, 152 or 172. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585; fax (714) 458-6455. [10/99]

WANTED: all toy metal outboard boat motors; electric, wind-up and gas. Also wanted: .60-size spark ignition motors, thimble prone, etc., racecars. Call Richard, (616) 941-2111. [9/99]

WANTED: Horizon Models, twin otter kit. Call Bill, (707) 965-3866. [9/99]

WANTED: Monogram Speedi-Bilts. I buy, sell and trade all Monogram kits prior to Plastics. Loren Sisley, 19909 4th Ave. S.W., Seattle, WA 98166, or call (206) 824-2723. [12/99]

WANTED: plan for Midwest "Jetster." D/F trainer model. Maybe someone even has the unbuilt kit. Contact Stennard, 10 The Pound, Almondsbury, Bristol, England BS32 4EG. [8/99]

NAME THAT PLANE

Send your answer to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Can you identify this aircraft?

The winner will be chosen four weeks following publication from correct answers received (delivered by U.S. mail) and will receive a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner's subscription will be extended, free, for one year.

Congratulations to Albert Orr of Greensburg, PA, for correctly identifying the June '99 mystery plane, the Miles M.2X Hawk Trainer. The spruce and plywood airplane was designed by F. G. Miles and manufactured by Phillips and Powis Aircraft Ltd. in 1934. The M.2X was one of 25 aircraft built for the RAF Reserve Training School. This two-seat light monoplane measured 24 feet in length and had a wingspan of 33 feet. The trainer was similar in appearance to its predecessor, the Miles Hawk Major, which competed in the MacRobertson races from England to Australia.

Index of Manufacturers

Ace Hobby Distributors, 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037; (660) 584-7121; fax (660) 584-7766; website: www.acehobby.com.

Airstar Intl., P.O. Box 4631, West Hills, CA 91308; (818) 710-8783.

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Du-Bro Products, P.O. Box 815, Wauconda, IL 60084; (800) 848-9411; fax (847) 526-1604; website: www.dubro.com.

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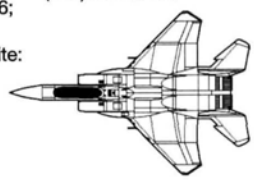

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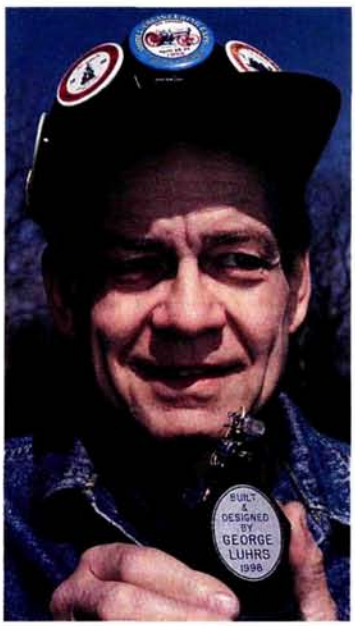
Advertisers

World's smallest gas 4-strokes

GEORGE LUHRS IS A MAN with a passion for tiny engines. His knowledge of internal-combustion engines is almost encyclopedic. It all dates back to age six, when he started building small elementary steam engines. In recent years, George has made a working steam engine with a piston diameter of 1/16 inch! Model airplanes, model boats, bikes, motorcycles and many other mechanical contrivances have always been of much interest to this prolific model builder. In addition to many other types of miniature engines, he has made a number of historic, working 1/8-scale models of 1-cylinder gas "hit-and-miss" engines that were universally popular before the electrification of rural America.



Now, this 58-year-old experimental engineering machinist of Shoreham, NY, has designed and built two of the world's smallest 4-cycle gas-ignition engines.

The first has a bore of 1/4 inch and a stroke of 5/16 inch, with a displacement of 0.015ci. The second is even more incredible, with a bore of only 1/8 inch and a stroke of 5/32. Its displacement is 0.0075ci!

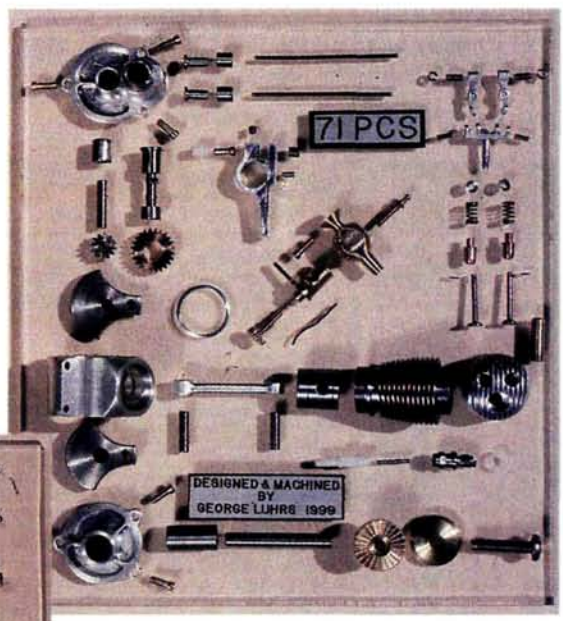
Both of these engines are completely scratch-built. The larger engine is made of 71 parts, and the smaller engine has 82 parts. The increased parts number is due to internal design differences. The compression ratio on both engines is approximately 6:1. Their brass carburetor assemblies are patterned after those in R/C engines, and each has a fuel-mixture needle and a throttle stop screw, i.e., the carburetors compensate for idle or fast running. Idle speed is around 900rpm, and top speed is approximately 4,000 to 5,000rpm.

The crankcase, cylinder head and all other aluminum parts are made of high-strength, heat-treated 7075-T7 alloy. All moving parts, such as the piston, connecting rod, cylinder, crankshaft, crankpin, camshaft and bearings are made of tool steel hardened to a Rockwell 65 scale.

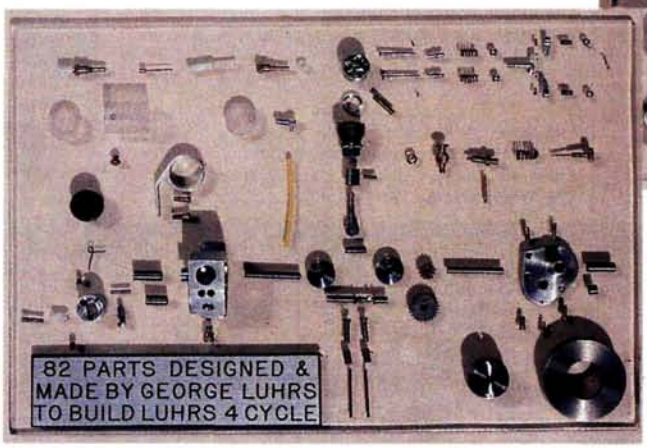
The valves, flywheel and some screws are made of stainless steel. Valve seats are machined and lapped, as are the piston and cylinder. Springs are made of 0.006-inch-diameter steel music wire. All assembled parts, such as the crankshaft and throws, prop drive and flywheel are press-fit together.

The subminiature spark-plug body is made of steel or brass with a Macor insulator, and the electrode is made of steel. Ignition points are tungsten. The ignition is supplied by a small model airplane-type spark coil energized with two AA alkaline batteries.

The engine burns Coleman lantern (white) gas that's mixed with Marvel Mystery Oil in a ratio of 50:1. The engines can be easily started by hand and run without making much noise.



Above left: two valves and a spark plug for the 1/8-inch-bore engine fit onto a dime with room to spare! Above right: these 1/4- and 1/8-inch-bore gas 4-strokes are fine works of art.



Above: there are 71 parts in the 1/4-inch-bore engine. Left: the 1/8-inch-bore powerplant comprises 82 parts!

These very tiny engines are the products of countless hours of dedicated spare-time work. Justifiably, they have won awards at recent model engineering shows in various parts of this country.